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Including SOUTHERN AVIATION and AERONAUTICS

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XUM

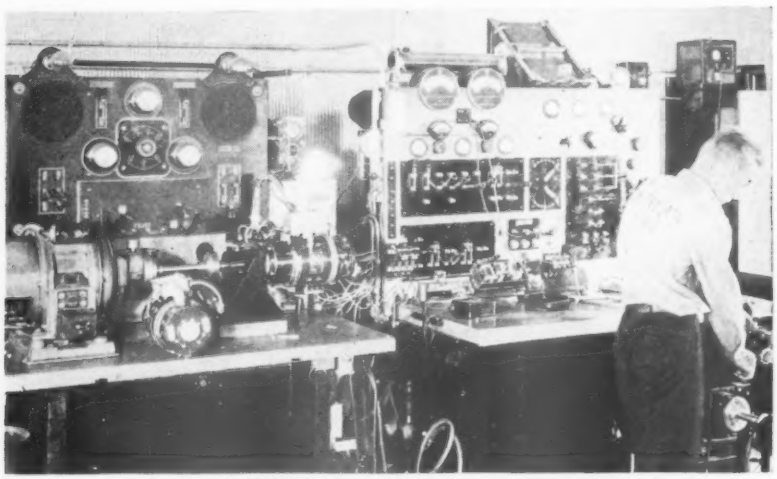
The Mechanical Service

by
E. STANTON BROWN

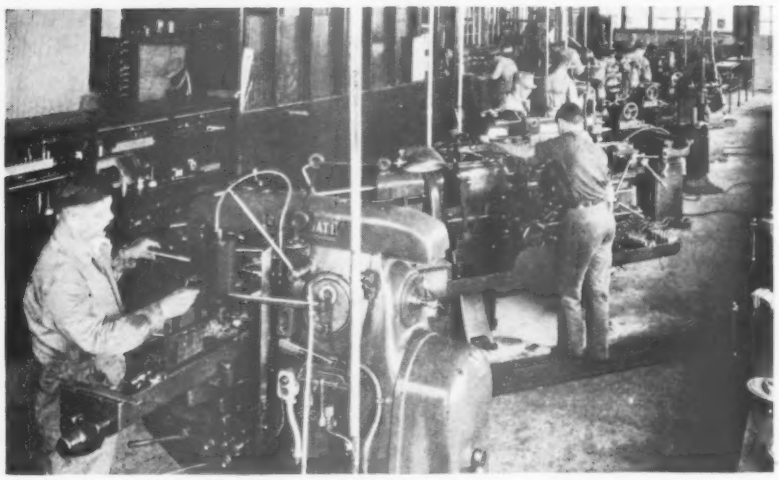
Commercial airlines editor of
POPULAR AVIATION.

Photos by Courtesy of United Air Lines.

The propeller testing and overhaul department of United Air Lines.



An engine accessory test stand for testing starters, generators, dynamotors, etc.



Machine shop for general metal work, showing the milling machines, lathes, grinders, drill-presses, etc.

UPON the mechanical efficiency of an airline's equipment rests the whole structure of the line; indeed the very future and reputation of air transportation itself.

Trips that are not completed because of mechanical trouble disrupt schedules, inconvenience passengers, often frighten them and add greatly to the cost of operation. Crack-ups and fatal crashes due to a mechanical failure at a crucial moment supply newspaper headlines which affect traffic volume for several weeks. Without mechanical efficiency of equipment, the Traffic Department has little to sell, the Publicity Department little to talk of.

Fortunately our airlines exist today because of years of never-ending attention to detail which has culminated in systems which now almost reach perfection and which keep our transports cleaving the air lanes night and day, flying millions of passenger miles yearly with an enviable record of safety and efficiency behind them.

In examining the system of maintenance and repair which actually keeps the airline in the air, it is only reasonable that we take as our example the very latest that has been accomplished in the field. The finger points to Cheyenne, Wyoming, where United Air Lines has established without doubt one of the finest, if not *the* finest repair base in the United States.

During the summer of 1934, consolidation of all overhaul and repair activity of the line was begun at Cheyenne. Within thirty days the change was completed, without interrupting the necessary routine of subjecting each company airplane to a major overhaul after a 350-hour period, a record in itself. Today all overhaul and maintenance work on United's fleet of Boeing 247 and 247-D transports flying over the New York, Chicago, Pacific Coast, Vancouver, San Diego, Agua Caliente and other routes is being carried on efficiently at Cheyenne.

One advantage of the consolidation of overhaul and repair work at Cheyenne is the flexibility it permits in the handling of flight equipment. All ships receive a complete overhaul, engines, instruments, appointments, and plane, every 350 hours. Plane No. 326 may be in service between Portland and Salt Lake City as it approaches its three

Department of an Airline

hundredth hour after complete overhaul.

At such a time the dispatcher on the Portland-Salt Lake City division transfers the plane to the Salt Lake City-Chicago division. The Cheyenne station then checks the accumulation of flying time on this airplane so that when it reaches its three hundred and fiftieth hour it is landed at Cheyenne and taken out of service for its overhaul period.

It is then shot into the largest of the six structures on the field, the main assembly hangar, 200 x 225 feet in size. Here it is completely dis-assembled and the various elements of the ship dispatched to their special departments for overhaul. Orderliness and production-line factory methods assure the maximum of efficiency and attention to detail.

An example of efficient hangar procedure is the cowl rack. Each rack accommodates the complete cowling for one of the Boeing 247 or 247-D engine nacelles. The shape of each piece of cowling is outlined on the rack, assuring each piece of its regular position and permitting the location of any particular section at a glance. In such a manner orderliness is maintained and the cowling is protected from damage which might accrue if it were permitted to be scattered about the floor.

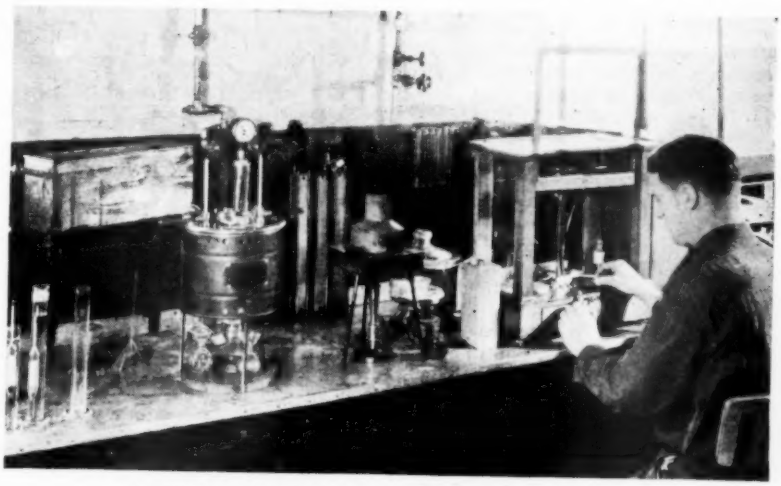
All upholstery of the ship is carefully gone over by the Sewing Department, and seats and curtains are repaired and replaced.

Engines are dismounted and sent to the engine overhaul shop. Here a complete machine shop, well equipped with modern lathes, milling machines, grinders, drill presses, and other equipment, is maintained. There is also an electric bake-oven for annealing, heat-treating, and baking of finishes on metal surfaces.

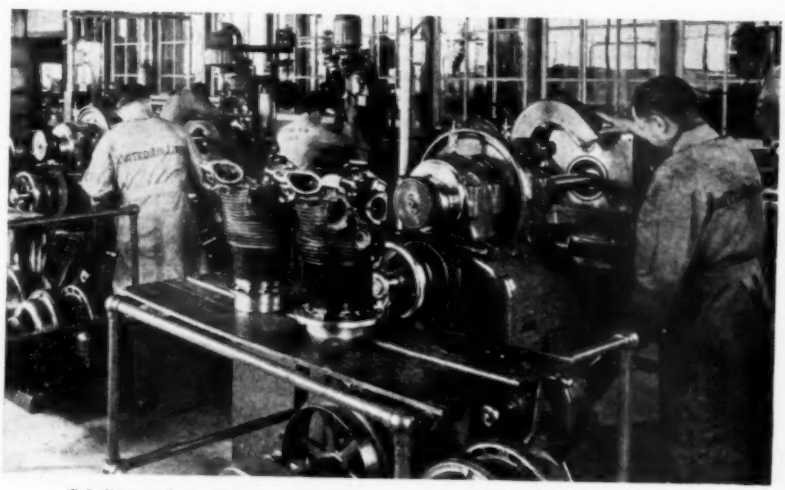
Cylinders are ground on special grinding machines. All parts of the engine are checked and either trued up or replaced. An important and interesting recent addition to the machine shop is a magnetic detector to determine hidden flaws in engine parts. The part to be tested is magnetized in the machine and then dusted with a special metal powder. The pattern the powder takes in the magnetic field set up, instantly reveals any flaws which might be hidden in the inner section of the specimen.

All engine accessories are sent to the engine accessories shop. Here starters, generators, spark plugs, dynamometers, carburetors and other parts are overhauled and repaired. After this work has been completed they are all tested on a special test stand before being replaced on the engine. When the completely overhauled engine reaches the

Magnaflux testing machine that detects hidden flaws in engine parts.



Testing the gasoline and lubricating oils used on United Air Lines.



Grinding engine cylinders at the Cheyenne overhaul and repair base at Cheyenne.

end of the production line it is placed on a test stand for a six-hour test before being replaced in the ship.

Propellers are sent to the Propeller shop where they are dis-assembled. The hubs receive a close examination and inspection of all their component parts. Bearings are submitted to a microscopic examination. The blades receive the same treatment and then are etched, polished, and balanced.

One of the most interesting shops on the field is the Instrument shop. The men employed for this work are specialists in their line and are highly paid. A watchmaker does no more skillful and delicate work than do these men, and, indeed, many of them were watchmakers before becoming airplane instrument men.

The shop is divided into two sections. The first services and repairs the instruments, and the skill of the workers, particularly on such sensitive instruments as the gyro compass and the artificial horizon, is well exhibited. A complete department does nothing but take care of and service the gyro instruments, while others handle the service and repair of less sensitive instruments. The second section handles the testing of the instruments on a special instrument test rack to determine their efficiency and accuracy after they have been serviced and overhauled.

A special radio service shop is maintained with a staff of skilled radio engineers to keep the company's airplane radio receiving and transmitting equipment constantly in good order. This shop however does not wait for the 350-hour checks before it takes equipment off the planes for service.

The company pays close attention to the service and overhaul of its batteries, due to the importance of batteries in maintaining the ship's lighting equipment and in two-way radiotelephone communication with ground stations along the airways. In the large battery shops United Air Lines maintains at Cheyenne it is possible to completely manufacture an aircraft battery.

A Sheet-metal shop is fully equipped for the usual sheet-metal and welding work involved in airplane repair and overhaul. In addition, special equipment is included for such projects normally not found in airline operation, such as pressing of cowling from dies and construction of engine rings.

At Cheyenne also is a test bench for fuels and lubricating oils. The company sets forth definite specifications for its fuels and this test bench is maintained to insure that gasoline and oils at all times meet the required standards.

Approximately five days after the airplane enters the hangar for overhaul and repair, it is taken out of the hangar and put in test flight, completely overhauled from nose to empennage. Every inch of the plane, propellers, motors, fuel system, oil system, the entire fuselage, and empennage, landing-

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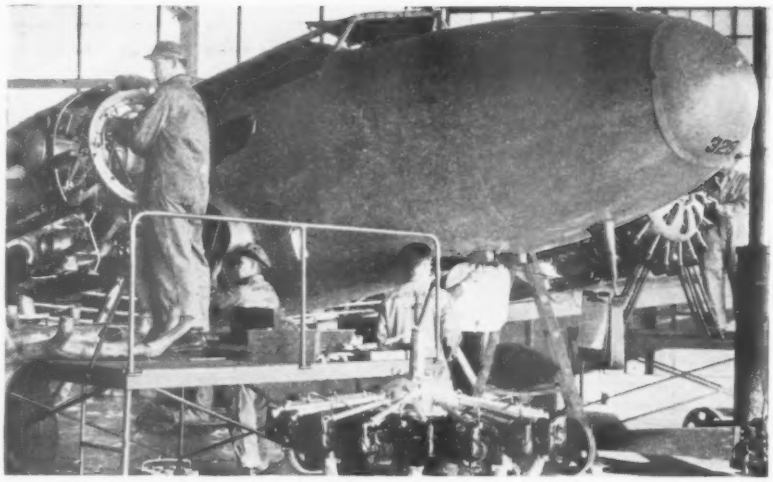
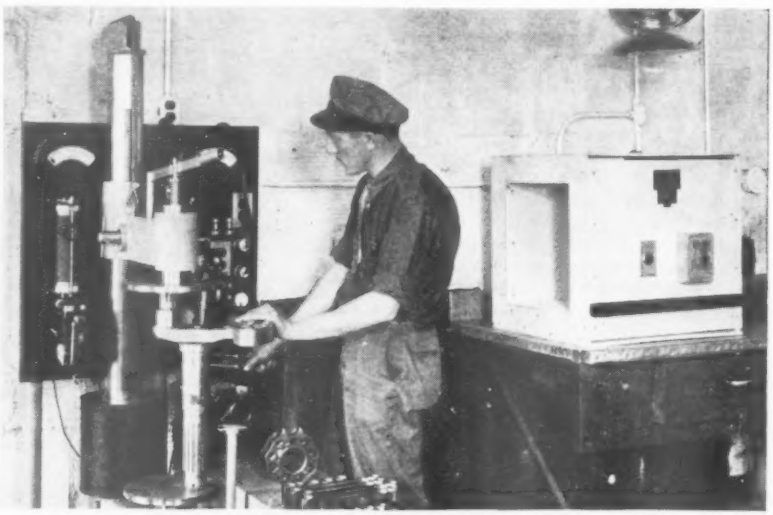


Dissembling a power-plant preparatory to a general overhaul and repair. The smallest parts are carefully checked after dissembly.



Details of Magnaflux testing machine being used for detecting flaws in an engine crankshaft. All cracks or checks are quickly revealed.

The instrument shop of United Air Lines where all gyro-operated instruments are repaired. The parts of these instruments are as delicate as those of a watch and require careful handling.

John Livingston—Race Pilot

by BARBARA POOLE

John Livingston, the subject of this text, is one of our best known racing pilots. He is now Chief Engineering Test Pilot for the Waco Airplane Company, Troy, Ohio.

I PRESENT to you, ladies and gentlemen (particularly, my dears, to the ladies!), John Livingston, racing pilot extraordinary, albeit a very wise guy!

John is the boy who sets hearts to pounding as he zooms around the race course and who, incidentally, doesn't do so bad with setting hearts to pounding on the ground except that he operates on a smaller scale and merely confines himself to one sex. Three guesses as to which. (Oh! Oh! You're 'way ahead of me!)

John, my friends, was gifted to the world in general on November 30th, 36 years ago in Cedar Falls, Iowa. I would say: to the "world of aviation" but, as it happens, there was no aviation in those days, however there wasn't any too much of John either and by the time he had developed from *a* baby into *that* little boy, airplanes had begun to compete with pole vaulters for the altitude record.

After fooling around with racing motorcycles and motorboats for some years without endangering any more than the respect of the majority of the people who knew him for his sanity, John bravely took a ride in what was then known as an airplane. He immediately became intensely interested in flying, thereby convincing the remainder of his friends that he was certainly "nuts" if nothing else.

Since this aura of "nuttiness" was what seemed to set the daring birdmen apart causing the general rabble to look upon them with admiring, if not worshipful, eyes, I doubt if John minded much. Nowadays, of course, racing pilots are still thought somewhat "nutty" but, unfortunately, any admiration on the part of a blaze' public has long since turned towards flag-pole sitters, marathon dancers, and Public Enemies No. 1.

I will admit that I have, at times, been able to detect a gleam of the aforementioned worship in the eyes of small boys and fat matrons attending air races. The occasion for the gleam in the eyes of the non-flying fat matrons is quite beyond me but perhaps John would know about that.

Had John's friends been able to look into the future they would have had their doubts concerning his sanity set at rest permanently. The gentleman is eminently sane to the tune of $56,000, his reputed race winnings during the past six years, and now that races and prize monies have appreciably decreased in the manner of all stunt exhibitions after the novelty has worn off, John has graciously and sagaciously retired to the excellent position of Chief Engineering Test Pilot for the Waco Airplane Company at Troy, Ohio.

"John is the boy who sets hearts to pounding as he zooms around the race course."

Whether or not he has definitely retired from racing he refuses to state, merely further evidencing just what a wise guy is the gentleman named John Livingston. However, he says that he positively does not agree with POPULAR AVIATION on the subject of air races.

He believes that without the air races of the past six years our present-day commercial and airline ships would be approximately 50 miles per hour slower than they are now, and races being means for progress of that sort could never, under any circumstances, be considered foolish. All of which sounds very good and, being merely an uninterested barnstormer myself, I'll let Mr. Livingston and POPULAR AVIATION thrash the matter out between themselves.

What really interested me in John Livingston's career was how he learned to fly. The fact is that he didn't. He merely followed what was evidently the usual custom about the year 1919, and rode around in a Jenny over the vicinity of Waterloo with E. K. "Rusty" Campbell. Finally, one day, he decided to ride around in the Jenny without Mr. Campbell.

Whether or not he managed to return the Jenny to Mr. Campbell in usable condition he does not say, but the matter of his own return is self-evident. The main advantage of this method of instruction, of course, is the saving of the daily wear and tear on the instructor's nerves. It takes him little more than five or ten minutes, as a rule, to determine whether or not his student will ever be a flyer, or whether or not his airplane will ever fly again either, for that matter.

John has now 4,600 hours and has won more National Cross Country Races than any other pilot. He also won eight of the eleven closed-course races at the National Air Races in Cleveland in 1931, the Cleveland to Cincinnati and return free-for-all race in 1932, and the Baby Ruth Trophy race in 1933.

What should really interest my feminine readers particularly (or should I say "reader"—well, I read my own stuff ennyhoo), is the fact that John Livingston is still a bachelor. That he has escaped so long merely goes to prove what I have said before and will say again, that he is a very, very wise guy indeed, indeed. Although who would want a racing pilot in the family anyway is a matter of never-ceasing wonderment to this chronic old maid who has already seen enough racing pilots to last through several very long lifetimes. I seem to be a minority overwhelmed by a very great majority of palpitating females, however, so mebbe I'm wrong, huh? I still don't think so.

But since his retirement as Engineering Test Pilot, his opportunities for fascination — opportunities only, mind you—have considerably diminished. He now deals mostly with members of his own sex where the lady rail-birds seldom see him.

John Livingston, in appearance, is lithe and bronzed with honey brown eyes and brown hair touched with gray at the temples. He has an ingratiating grin, but is rather serious without an obvious sense of humor. He is the type man who is never ignored by either sex; he has many enemies and many friends. Those who are his friends, remain that way.

He dresses well and in the best of taste. Somewhat aloof in manner, he is sometimes dubbed "high-hat," but as any celebrity usually earns this appellation unless he, or she, runs around shaking hands and grinning at everybody like a carpet-bag politician, the term may be taken with a grain of salt. He is known to everyone, enemy and friend alike, as an excellent pilot.

END

New Waco Military Type Plane

The Waco WHD mounted on Edo 39-4000 pontoons.

THE latest Waco model to be licensed as a seaplane is the convertible military plane, type WHD. It is intended as a two-seater fighter or can be employed as a sportplane for civil use.

The WHD Waco is fitted with a J6-9, 420 horsepower engine and is mounted on Edo Model 39-4000 floats. It was test flown by John Livingston, and while performance figures are not available at the present time, it is said to be the fastest Waco model yet flown on floats.

One of the most interesting features of this new plane is its unusual cleanness of design, its excellent visibility and the unusual position of the elevator and horizontal stabilizer.

The Giant French Airliner Completed

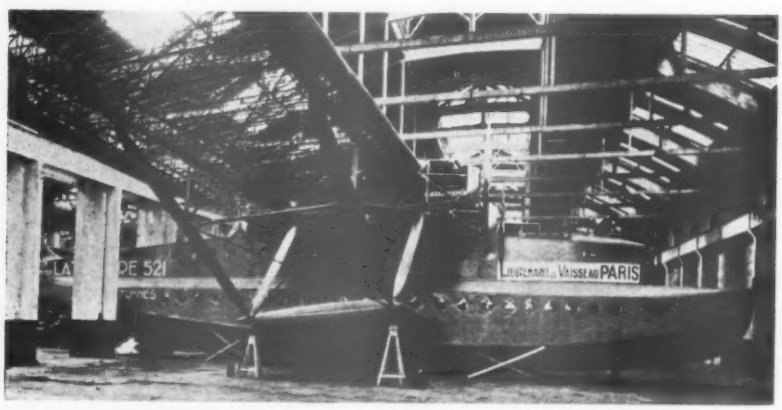
THIS is a side elevation of the Giant French Airliner, "Lieutenant de Vaisseau Paris," recently completed at Toulouse and now being rigged for its trial flight to take place at Biscarrose in the south of France.

This giant flying boat is equipped with six Hispano-Suiza engines developing a total of 5,000 horsepower. It contains twelve deluxe cabins and has a maximum capacity of 70 passengers. The top speed is 150 m.p.h.

This ship is an all-metal construction job in which stainless steel is employed extensively in the hull and structural members while aluminum alloy is used in the wing and tail-surface structures.

Particular attention has been paid to hull strength and safety while riding the sea, the hull being provided with a great number of bulkheads and compartments which reduce the liability of filling with water and add additional strength. It is said that the form of the hull is such that it planes over the water with unusual ease, making it easy and simple to take off on calm water.

Facilities for serving meals are provided for the passengers, together with other conveniences such as reading lights, individual ventilation and lavatory service. The gasoline tanks are so located that they give an excellent distribution of weight without being a menace to the passengers in case of forced landings.



The French airliner "Lieutenant de Vaisseau Paris" under construction.

Jest for Fun

by DAVID F. KIRBY

THE world seems to be adopting "theme songs" for every sort of thing. The radio has them by the dozens, the movies by the gross and so on.

Maybe we can find one for aviation. How would you like: "Swing Low, Sweet Chariot"? Of course, an airplane mustn't swing too low, or it will get tangled in the tops of trees, or fly into the windows of the top stories of some of the tall buildings in the cities.

This reminds me of the answer given to an interviewer by a prominent airman. The newspaper man asked the aviator what, in his opinion, would be the greatest improvement in the next ten years of aviation.

"Well," replied the flyer, "I think an important improvement will be lower skyscrapers. Of course, there may be another improvement in the way of cutting off the tops of tall trees, but I think that the most important of all will be the invention of softer rocks to fall on."

But, when it comes right down to that, the place of an airplane is in the sky. Otherwise, it resembles a man I heard of the other day. This gentleman was a lazy man—a *very* lazy man. His wife was speaking of him to a friend.

"He's just like an airplane," she said, "he's no good on earth."

Forsooth, what good would an airplane be on the ground? It would be something like a trolley-car, you could not steer it. I remember once seeing a trolley-car coming down the street and directly over-head was an airplane traveling in the opposite direction. I recall having a naive thought to the effect that were they both traveling on the same level no power on earth could avert a collision. For neither could turn out for the other. A silly thought, but one that gave me a little amusement.

As I have said, the place for an airplane is in the air. There it will meet with no interruption on its flight. It can go practically as fast as its pilot desires. In fact, it has even been said by competent authorities that it can move with a speed even greater than that of a bullet.

In other words, if you were a traffic cop in the air and wished to call a halt to an offending pilot, and fired a bullet at him, after the manner of a terrestrial traffic officer trying to puncture the rear tire, or whatever they do —if, I say, you fired a bullet at the rear end of the speeding plane, the plane could out-distance the missile.

Theoretically, this is true, but I imagine that the applicant for the job of testing this theory in practice would meet with very little competition.

Speaking of guns and bullets and so on, brings to mind the story about the

(Concluded on page 186)

The Early U.S. Army Air Corps

by LIEUT. H. LATANE LEWIS

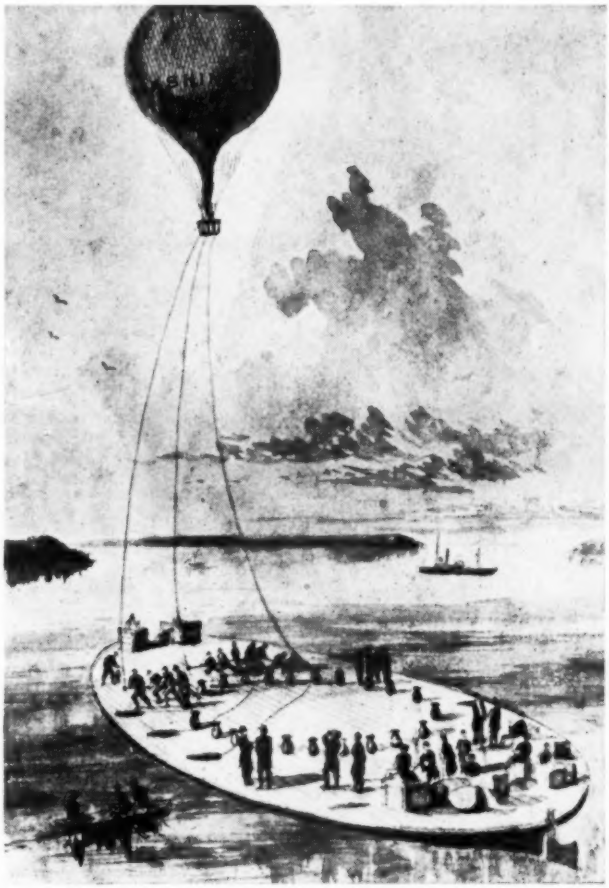
The U.S. Army Air Corps is really an old institution, much older than realized by many of our readers. Lieut. Lewis sheds new light on the Air Corps during the days of the gas bag.

NOT many of us realize that we had an Army Air Corps as far back as the Civil War. There actually was one, however, and many an old veteran will recall the awe-inspiring sight of a large gas-balloon floating majestically over the heads of the troops.

Inside the basket of the balloon, during these flights, was a figure garbed in a frock coat and a high silk hat, who peered earnestly through a long spy-glass. He was Thaddeus Lowe, a pioneer aeronaut, and his observations of enemy movements turned the tide in many a battle.

At the outbreak of the war, Lowe was planning a trans-Atlantic flight in a balloon. He believed that, due to the rotation of the earth, there was a strong current of air blowing from west to east. He believed that all he would have to do would be to ascend into this current and, if he could keep his craft in the air long enough, he would be carried to Europe.

In preparation for the flight, he ascended at Cincinnati to test his theory of the westward current. His opinion, indeed, proved to be correct and he was soon sailing off in an easterly direction at good speed. The big gas bag traveled eight hundred miles and landed on the coast of South Carolina. It came to earth just at the time that South Carolina seceded from the Union and Lowe was regarded as a spy. He met with hostile treatment and barely escaped with his life.



Here is an early observation mission with what might be called the first aircraft carrier. A special platform on a small steamer carried the gas generating plant and acted as mother-ship to the captive balloon floating above it. It is worthy of note that this method of observation and artillery spotting continued for many years, even up to the time of the World War where captive balloons were employed in both the army and navy.

He volunteered his services to President Lincoln at once and was accepted. The air corps, which he organized, consisted of five balloons which were christened, *Intrepid*, *Constitution*, *Washington*, *Union*, and *Eagle*. They were constructed of India silk, with flaxen cordage, and were highly varnished to make them weather- and gas-proof.

Inflating these bags and operating them in the field called for considerable ingenuity on the part of Lowe. He devised large air-tight wooden tanks, mounted on wheels, for generating the hydrogen gas with which the balloons were filled. The deflated balloons could be packed into a wagon and carried to the point of action. Here they were stretched out upon the ground and attached to a tube projecting out from the generating tanks. Hydrogen was produced by the action of sulphuric acid on scrap iron, the process of inflation requiring about three hours.

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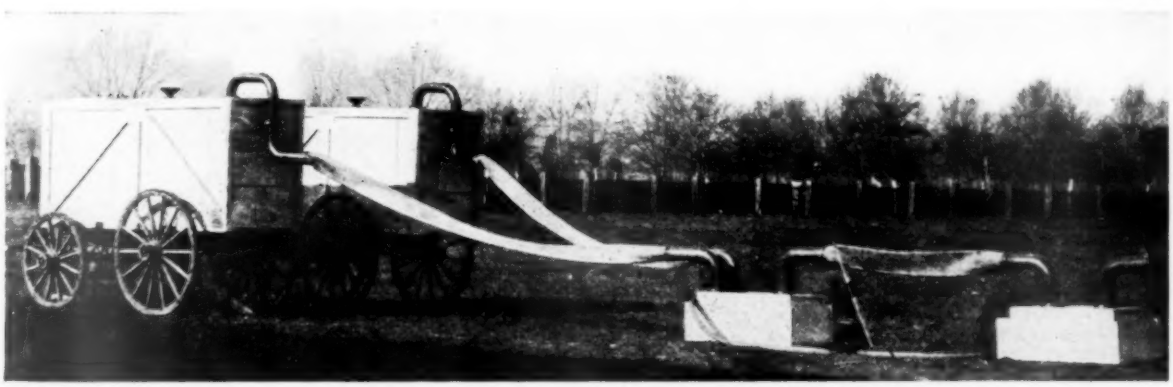


This is the primitive hydrogen gas generating plant used for filling the balloons during the early days of the U.S. Army Air Corps. The generators are the tanks on the trucks, while the washers and cleaners are the boxes at the right on the ground.

Are Rocket Motors Practical?

by CALEB McNASH

The great amount of interest shown recently in rockets has induced many of our readers to ask questions on the subject. In this article, the author answers many of these questions that are of fundamental importance.

IT was on November 4, 1933, that Herr Otto Fischer climbed into the cramped cabin of his 24-foot rocket and, opening the fuel valves, ascended to a height of 32,000 feet, or six miles and 320 feet, startling a skeptical scientific world into the realization that the liquid-fuel rocket was not a Fourth of July toy, but a powerful and efficient mechanism capable of amazing feats of speed and power.

This remarkable ascent, the first of its kind in history, was made on the island of Ruegan, in the Baltic Sea.

The acceleration of the rocket during the climb was so great that it caused Fischer to lose consciousness. When the rocket had reached its maximum height and had started to descend by parachute, however, he regained consciousness in time to descend by his own parachute. The whole trip, ascent and descent, lasted but 10 minutes and 26 seconds, both man and rocket returning to earth unharmed.

The elements of a new rocket recently developed by a California rocket society. In this rocket, liquid oxygen is employed to burn the charge of fuel.

The design of this rocketship was not at all like those generally pictured as being the ideal and most logical type. The rocket motor towed rather than pushed the cabin through four tubes, and was swiveled in such a way as to enable Fischer to change the angle of the rocket blast, thus having a steering effect. The motor itself was three feet long and twenty inches in diameter, and developed a lifting power of 1,500 lbs. The fuel tanks were in the cabin and the liquid oxygen and gasoline were conveyed to the motor through smaller tubes within those which did the actual pulling.

To most engineers it is rather obvious that the limit to speed in the lower stratas of the atmosphere with the present type of plane and motor has almost been reached. While it may be possible to increase the already tremendous horsepowers now being used in the high-speed airplanes sufficiently to coax a few more miles per hour from the overstrained airfoils, no great advances may be expected.

The resistance of the air, increasing at the lower speeds as the square of the speed, and as the cube at the higher speeds, is too great. But ascend to a height of ten miles and see what the engineer's figures indicate. At this height the air density is roughly 1/10 as great as it is at sea-level, and an airplane capable of 200 m.p.h. at sea-level should be able to go approximately three times as fast, or 600 m.p.h. due to the decreased resistance.

At a height of 30 miles the density is but 1/1000 as great as at sea-level, and should easily permit a speed of 6,000 m.p.h., still using the conventional 200 m.p.h. airplane, with no increase in horsepower. This logically brings to view the possibility of a flight across the Atlantic in perhaps thirty minutes, made without danger of storm or wind, using the serene and unruffled stratosphere—the ideal medium for transportation.

The drawback, of course, has been the fact that the conventional airplane motor and propeller decrease rapidly in efficiency at the higher levels, both motor and propeller depending upon the atmosphere for their power. To overcome this decreased efficiency attempts have been made to supercharge the gasoline engine, and to provide the propeller with blades whose pitch can be changed to compensate for the varying atmospheric pressure or density. However, nothing remarkable has been achieved in this field and it is doubtful if there ever will be a gasoline engine or propeller developed that will maintain a workable efficiency at the higher altitudes.

The remarkable feature of the rocket motor, on the other hand, is that it achieves its greatest efficiency in a vacuum!

To most people this is a fact that is hard to accept.

"How can a rocket produce power," most of them inquire, "if there is no air for the rocket exhaust to 'push' against?"

The answer is simple. The rocket motor operates according to Newton's law, "For every action there is an equal and opposite reaction." The mass of an accelerated body, times the velocity it assumes, is equal to the mass of the body from which it accelerated times its velocity in the opposite direction.

For example, if a 200-pound man, suspended in space, threw a one-pound weight so that it assumed a speed of 200 m.p.h., he would assume a speed (in the opposite direction) of one m.p.h. It is on this principle that the rocket motor operates, and the atmosphere is but a hindrance to its operation, decreasing the acceleration of the exhaust particles. To use another example, when a man dives from a boat, the boat moves in the opposite direction, and this action is entirely independent of the atmosphere, or anything but the weight of the boat and the weight of the man.

The rocket motor works in the same manner, but the relatively light particles of exhaust gas must be accelerated to a very high speed to move the relatively heavy rocket with any appreci-

(*Concluded on page* 182)

The All-Metal Airship Arrives

by RALPH BAKER

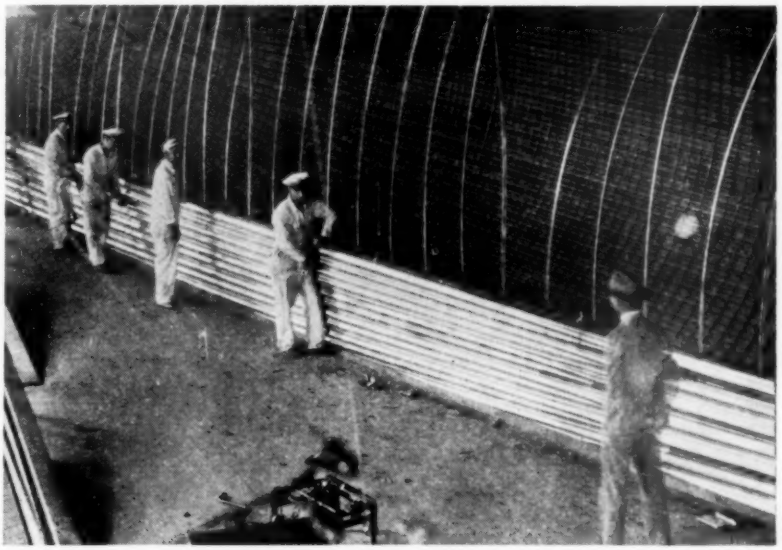
While all-metal airships have been constructed, yet this new ship shows such remarkable features that it may be considered as representative of a new type that is destined to a future commercial type.

EMBODYING the most recent thought in rigid airship construction, this new all-metal ship is designed especially with the view of adaptation for commercial use. Although differing from former dirigibles in method of construction, loading, steering, and propulsion, all the principles involved are based on familiar engineering laws.

The possibilities of the dirigible as a passenger and freight carrier, and for military service, have long been recognized because of its great load capacity and wide cruising range. New interest has been aroused in heavier-than-air craft by the recent announcement by the Government that it would construct a sister ship to the Macon, and by the air mail promises to Dr. Eckener. Government officials, including General Mitchell, have lately expressed their belief in the possibilities of the dirigible, and have urged greater development of the nation's resources along that line.

Commercially, the chief objection to the dirigible has been the time taken for landing and loading. Most of their advantage in speed over such carriers as trains, for instance, is lost in anything but long hauls because of the fact that every stop for loading takes from six to ten hours.

As an instrument of war, the chief fault of the dirigible has been that it was too easily brought down. The public, remembering the fate of the Shenandoah and the Los Angeles, has not been disposed to entrust their lives to such fragile craft.



Showing the hull construction with the circular ribs and duralumin strips that constitute the entire structure.

These are the general problems that the new dirigible was designed to solve!

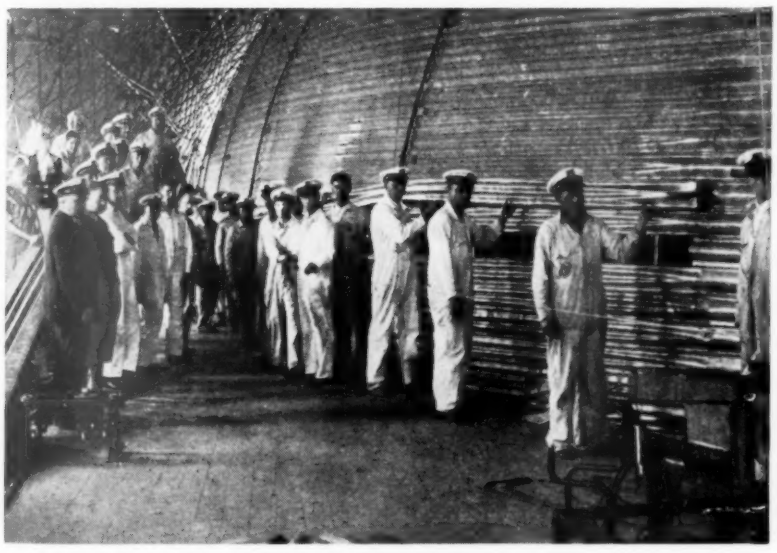
It reduces the time of loading freight and passengers to about one hour by means of an elevator and anchor system which eliminates mooring masts and expensive ground crews, and enables the ship to effect a landing at any desired point without previous preparation or assistance from the ground. The ship is equipped with a cylindrical elevator cage, about four feet in diameter and seven feet in height, and constructed of the same material as the rest of the ship—duralumin.

Landing is accomplished by hovering the ship over any chosen spot and lowering the anchor either to the ground or to the roof of a building in the heart of a city. A clear space some thirty feet square is all that is required. Equipped with 3,000 feet of steel cable, loadings are possible from any altitude up to that distance.

The anchor is utilized further as a fuel tank, its weight being principally derived from the gasoline it contains. Since gasoline must necessarily be carried, the weight of an anchor heavy enough to moor the ship is economized by this means.

After the ship has been anchored, its cable is used as a guideline for the elevator cage, which is lowered and raised by its own cable. From one side of the cage extends an arm having at its end a roller similar to that of a pulley, which runs on the anchor cable as the cage is lowered.

When the cage arrives at the loading place, passengers are taken on or discharged similarly to and as safely as passengers in an office building elevator. On being raised to the ship, the cage enters the cabin through an opening in the floor, and is received in a stationary tubular metal slip inside. With this device passengers may be



The hull nearly covered with duralumin strips. Note the semi-circular form of the strips given to them to create a rigid hull.

taken aboard from almost any conceivable point below, and the whole process accomplished with little more sensation than that experienced in an ordinary elevator.

The time required for a single trip depends somewhat on the distance of elevation and general conditions, but under ordinary circumstances, mooring and several trips may be made in one hour. Freight is loaded in the same manner, a one-man ground crew being all that is necessary. Frequent stops may be made without greatly decreasing the ship's traveling time because of the short time required to make them.

While it is, of course, impossible to build any aircraft that cannot be brought down by shell fire, this new dirigible goes a long way in that direction, and practically eliminates the danger of a complete and sudden collapse, a danger that has always menaced the non-metal dirigible. Once a hole is made in the non-metal bag, outside air pressure pushes the cloth inward, forcing the gas to escape, and causing the whole structure to collapse.

No such result would occur in this new ship. In actual tests which were conducted, a number of holes were made in a large model metal bag, one almost large enough to admit an automobile, and not only did it not collapse, but the gas did not escape for several hours. In this case the outside air pressure served only to hold in the lighter helium gas with which the shell was filled.

It is estimated that even though the ship might be struck by several shells in military action, it would still have several hours—from one to three—before it would be forced to land. The advantage of this as a military factor is obvious.

In a metal ship, economy of weight is essential. Such economy is effected in this dirigible in several ways, chief of which is the manner of constructing the hull. Its design is based on the double arch, or "eggshell" principle, and its superior strength is obtained, not from an inside frame, as is the case with cloth-bag construction, but from the cover itself by the curvature of the surface in all directions. The cover, which is also the lifting gas container, is corrugated longitudinally to give the hull the necessary rigidity.

It is made of duralumin strips 150 feet in length which are corrugated at the plant by running them through machines especially designed for the purpose. The edges of each strip are curled so that they will slip into the curls of the adjoining strips. The fitted edges are coated with a special fluid called lionol, and then pressed flat, sealing them gas-tight. This not only does away with the slow and expensive process of riveting, except at the ends of the strips, but produces a more efficient joint. Besides the joints, the entire inside and outside of the hull is coated

(Continued on page 196)

The Aero-Sportswoman

by JOAN THOMAS

A group taken at the Kenosha luncheon of the 99's. Miss Thomas is in the picture, guess which one she is.

"HOW very modern," mused Mrs. Frederick T. Haskell of Chicago, after we came down from taking a flight over the city in one of the American Airways new *sleeper* ships. "Twenty years ago an anniversary at such an occasion as this would have been spent laying wreaths and listening to speeches. Today we go up in the air to pay our respects."

The occasion was the thirty-first anniversary of the Wright brothers' famous flight at Kittihawk, which was so dramatically celebrated on December 17. Designated as National Aviation Day, plans were made for a great mass demonstration and at 10:30 a. m., thousands upon thousands of airplanes all over the country took off to commemorate the hour of that first feeble attempt of man to conquer the air.

Though Mrs. Haskell was not present at that first epoch-making flight, she told us of how she had been fortunate enough to witness several history-making aviation events. She was in London when Bleriot flew the Channel . . . on the field in Vienna when Franz Josef welcomed him to Austria in the first airplane that ever flew over Austrian soil . . . and in Paris when Lindbergh landed!

Among the other Chicago women who accompanied Mrs. Haskell on the Wright Anniversary flight were Mrs. T. Mitchell Follansbee . . . Miss Sophonisba Breckenridge, famous social worker and educator . . . Mrs. Henry Field . . . Mrs. Schuyler Terry, national governor of the Women's National Aeronautical Association . . . Miss Margurite Green, president of the Chicago unit of the W.N.A.A., and the editor of this column, representing the Ninety-nines.

Miss Breckenridge, like her famous contemporary, Jane Addams, is an aviation enthusiast. She never misses an opportunity to fly and has taken several long trips by air. When she was sent to represent the United States at the Pan-American Conference in 1933, it took her 17 days to reach Monte-

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LEFT TO RIGHT: Ruth Harmon, Ruth Wakeman, Gayle Pond, Vi Crosbie, Alice Hirschman, who attended the "99" luncheon at the Municipal Airport, Chicago, Ill.

Flying With the Gates Circus

by E. J. (EDDIE) BOND

Recollections of the exploits performed by the old-time Gates Flying Circus of which the author was a member. These were daring, resourceful men that gave the crowd many a shiver.

BACK in the winter of 1925—before the Department of Commerce governed civil aviation—aviators flew anything that had wings and in any manner that they chose.

The Gates Flying Circus moved into Florida to spend the winter, barnstorming its way from town to town. The pilots at that time were Clyde Pangborn, Jack Ashcraft, Wilmer Stultz, Freddie Lund, and myself. Buck Steel joined us that winter in Florida. We were all flying Hisso Standards.

Nothing eventful had happened since my forced landing in the wilds of West Virginia. I was born and raised in Texas but had to go to West Virginia to see wild country. However, that is another story.

We arrived at Daytona Beach, Florida, and started our customary activity of carrying passengers along with a few wing-walking shows, put on by George Babcock who, I believe, was about the best man I ever met in that line of work. George was a small fellow with the physique of an acrobat, wiry and tough, a good-natured youngster who was afraid of nothing.

"Van" Gates, our boss and promoter, made a deal to put on a show at Daytona that included, among many things, a change between a speed-boat and an airplane. It fell to my lot to pick George Babcock out of a speed-boat with a ladder, dangling from my lower wing. The change was to be made in the Halifax river at a point between two bridges. The Halifax river separates the towns of Daytona Beach and Daytona.

The day for the show dawned clear, cool, and calm, but I had hoped for a strong breeze, blowing from the north or south (the same direction as the river) as flying into a strong head wind would allow me to fly slower, relative to the ground, but would not retard the speed of the boat.

The day continued practically calm and finally the time came for the pick-up. George was in the speed-boat, which was about twenty feet in length and had a closed-over deck from the bow to the small open cockpit at the rear. I took off from the beach, with the rope ladder fastened to the right lower wing at the first bay strut, the loose end being pulled up from under the trailing edge of the wing and into the cockpit.

As I started toward the river, and the waiting thousands that lined the west bank of the river, I dropped the loose end of the ladder and started looking for the speed-boat. It was circling around in the river, but it looked pretty slow to me looking down on him.

An old Hisso Standard plane used by the Gates Flying Circus and branded with the Texaco Oil star, the insignia of the company that provided Gates with gasoline and oil.

We had arranged in advance for the driver of the boat to start at full speed from the north side of the north bridge and to drive in a straight line under the bridge toward the south bridge. I circled over them and, as they went under the bridge, I was over them and about two hundred feet behind with my motor throttled.

I glided down over the water, after passing the bridge, low enough for the ladder to be about twelve inches from the water. I then eased the throttle and flew up to the boat. I could see George grinning at me as I approached and the driver taking rapid glances over his shoulder.

A second later, the ladder clipped the water a few feet behind the boat and then slid into the boat's cockpit. It seemed to be moving about ten or fifteen miles per hour faster, than the boat. George grabbed it, and pushed it away from the driver's head.

A second later, I was in front of the boat and climbing to clear the South Bridge in front of me. With an open throttle, I climbed and turned back for another try. I could see that George was not going to take the ladder unless I could slow down, even more than I had. We went back to our starting positions and this time I came in over the bridge in almost a stall.

The plane was settling as I cleared the bridge and the boat was just in front of me. I eased up the throttle again, just enough to retain flying speed, and I could see that I was approaching the boat more slowly. I could see the end of the ladder plainly, as it was held by the air on a slant.

The last rung of the ladder went into George's hands, about even with his waist and he grabbed both hands full of ladder. I slammed the throttle wide up and the old 180 Hisso took it without a cough. I looked, and George was being dragged over the deck of the boat on the seat of his pants.

There was no smile on his face now, instead he had a tight-lipped expression. I remember wondering in that split fraction of a second if there were any splinters on the deck of the boat.

I tried to climb, but the ship wanted to settle on the right wing. I seemed to be losing the inches of altitude I had. George's weight was pulling me down and I could not lift that wing back up. George had slipped off over the bow of the boat and, with a splash, he had struck the water with his "fanny," his hands and feet in the air but still holding on to the ladder.

The ship climbed six inches—a foot—George was clear and I had the wing back almost level. The old Hisso had pulled me ahead, and out of a tight hole. But just then the bridge was right on top of me! I could not turn to the right, or George would be in the water, and pull me and the ship with him. It was impossible to bank to the left, with George's weight on the right wing.

Straight ahead was the only way out. I just had to stare at the bridge and hope that I could gain enough speed to climb over. I think I pulled up on the stick, it would not do much good to pull back at that speed, but in a few seconds, I had gained enough speed to clear the bridge with George and he was looking over the lower wing at me with the grin back on his face. "Whee," it was a relief! We both sat grinning at each other and shaking hands with ourselves.

My next job was to put George back into the speed-boat. We flew back to my starting position again, but the boat was floating idle on the river and the

driver was working over the motor. We flew around and, after a while, decided the boat was out of commission, so we went back to the beach and landed. "Van" Gates was not long in arriving and we discussed the boat failure.

"Van" insisted that if the boat could not be repaired immediately we would have to substitute some other stunt. He decided that George was to step off the end of the ladder into the water. Well! George was not so keen for that idea, but Van sold it to him and we took off.

The boat was still out of commission when we arrived over the river, so we prepared for George's bath. He climbed down on the ladder, I came in over the bridge again and let the ship settle down from slow flight until at last, George was about a foot from the surface. He turned the ladder loose.

I pushed the throttle wide open and had no trouble in climbing out in a turn. I had not taken my eyes off of George. Just as he struck the water he curled up in a ball, his head between his knees, and his arms around his legs. He skidded across the surface like a huge stone. He must have struck about six or eight times before he lost speed and went into the surface. He then uncoiled and started swimming toward a skiff, that was close by.

I flew down over the skiff as he crawled into it and we waved to each other. That was the end of the aqua activities of the Gates Flying Circus for that day.

IN the fall of 1924, the circus was composed of three ships; two Hisso Standards and one Liberty-Six Standard. The pilots were Clyde Pangborn, Billy Brooks, and myself. Milt Girten, Aaron Kranz, and Phil Lanenger were the stunt men.

At Memphis, Tenn., Gates had secured the use of the Driving Park as a flying field—and a good one it was. He also had made a deal with some civic organization to assist in raising money for, as I remember, the purpose of buying an organ for the new City Auditorium. The attendance at the Driving Park was heavy, in spite of the admission charge to the grandstand.

Pangborn was in Arkansas with a burned-out rod bearing; leaving Brooks and me to put on the show. It called for a wing-walking show, parachute jump, dead-stick landing, stunting, night fireworks and a plane change.

Everything went well until we got into the plane change. Brooks was flying the Liberty motor, which was 20 horsepower more than my Hisso, and also weighed about one hundred pounds more—radiator and all. I was carrying Phil on my top left wing, while Brooks had the ladder on his right wing.

The correct procedure for a change is for the ship carrying the man to fly

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The Lockheed Flying Camera

The Lockheed plane built around a camera. It is provided with the most modern photographic equipment for making aerial views.

A FLYING camera, the first of its type in the world, has just been completed by the Lockheed Aircraft Corporation at Burbank.

It's a 300-mile-an-hour low-wing monoplane, built around the finest aerial lens available. The camera, mounted in the wing, shoots pictures like machine guns at the touch of a button.

The camera is in the left wing about eight feet from the cabin. A gunsight mounted on the pilot's windshield serves as view-finder. By pressing a button on the control stick it will take 110 pictures in succession at two-second intervals.

Auxiliary cameras take pictures straight down through the floor and directly behind from a compartment in the rear. Each works automatically.

A New Device for Studying the Weather

The new theodolite in use at Pan American Airways.

PAN AMERICAN AIRWAYS at Miami, Florida, has adopted a new device for recording weather conditions aloft. It is of the utmost importance that accurate knowledge of climate and storms at various levels be furnished pilots so that they may select the most efficient flying altitude.

Throughout the tropics there are vast regions where heretofore no organized weather service has been available, and because the Pan American network of routes covering the Caribbean area and South America is dependent upon specific information covering these points, it became necessary for the Airways to install its own weather information service.

The newest device in use is a specially designed theodolite which enables a single observer to trace and record the course of a free balloon through the currents of the upper air. A small rubber hydrogen-filled balloon is released and the observer marks its travel through a theodolite, an instrument equipped with a telescope and circles for measuring the vertical and horizontal angles of the balloon with reference to the observation point.

The recording theodolite enables a single operator to determine the winds aloft as the horizontal projection of the balloon's path, or the position of the balloon in space, is recorded automatically on a paper protractor thus making it unnecessary for the operator to compute the distance traveled by the balloon.

Another feature of the new instrument is the clock which rings at the end of each minute to warn the observer to properly focus the balloon. Then there is a separate small telescope—called the optical finder—which assists in relocating the balloon after it has disappeared on account of a passing cloud or for any other reason.

An ingenious small generator which makes gas from ferro-silicon and caustic soda is stationed at isolated stations to furnish a supply of hydrogen gas for the balloons.

Propeller Shears a Beam

by WALTER E. BURTON

A peculiar accident is described which demonstrates the tremendous force that can be developed by a rapidly revolving propeller. It should be noted that the speed of the blade approaches the speed of a rifle bullet and hence is capable of wrecking any ordinary structure.

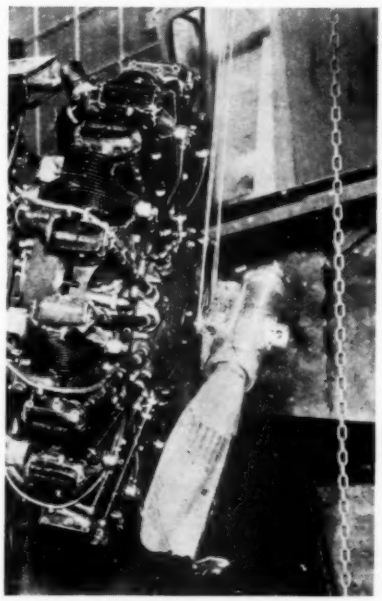
THAT a tremendous amount of energy can be stored in an airplane propeller blade was demonstrated dramatically not long ago at the Army Air Corps experimental plant at Wright Field, Dayton, Ohio.

A steel propeller, designed for use on a 450-horsepower engine, was being operated on the test stand at 710 horsepower. Without warning one of the blades broke near the hub, shot towards the roof of the test shed, severed an 8-in. steel I-beam, passed through 6 in. of solid oak wood and finally was stopped by 12 in. of concrete above the oak.

The cut in the steel beam was remarkably clean, the surfaces having a smooth, burned appearance, indicating that the blade actually had burned its way through the steel. Engineers estimate that the blade was traveling 600 miles per hour when it struck the beam.

Later examination of the slightly bent blade, and careful testing in the laboratory, showed no sign of even the smallest crack in the metal. This demonstrates the high state of perfection that has been attained in metal blade construction. The sudden departure of one blade of the propeller being tested upset the balance of the speeding engine to such an extent that it was torn from its mountings on the test stand, as if some giant hand had wrenched it loose.

Note the 8-inch beam sheared by the propeller blade.



The engine was torn from its mountings.

Propeller testing is an important activity at the Wright Field laboratories, for the propeller is one of the most important parts of an airplane, and one about which much still remains to be learned. Efforts are made to avoid mishaps when operating propellers under abnormal conditions; but when they do occur, the engineers generally learn more than if the test had been uneventful.

Among the reminders of such "accidents," which can be seen at Wright Field, is a propeller with much of both blades missing. When this was being tested some years ago, someone neglected to remove a loose board from nearby scaffolding. Suction created by the propeller picked up the board and drew it into the whirling blades, with the result that both board and blades were shattered.

Propeller research is being carried on with the purpose of avoiding such accidents as befell Jimmy Doolittle in 1927. He was flying a pursuit plane at 20,000 ft. over Wright Field. In a dive, one blade of the propeller broke off and came to earth about 16 miles from Dayton, near Brandt. The other blade tore loose and landed between the sidewalk and curb of a Dayton street, not far from where some children were playing.

At a speed of from 900 to 1,200 feet per second, a speed approaching the speed of a bullet or shell, the force of impact is tremendous. This is amply demonstrated by the accident in which a shearing cut was made across several square inches of steel surface. This impact is furthered by the fact that the molecules of the softer propeller metal did not have time to flow back when contacting the harder steel of the beam.

This accident suggests the dangers attending the use of large-diameter high-speed propellers and that this difficulty could be avoided by the use of smaller blower rotors or other reactors.

Here are the fragments of the propeller blade and a short section of the I-beam.

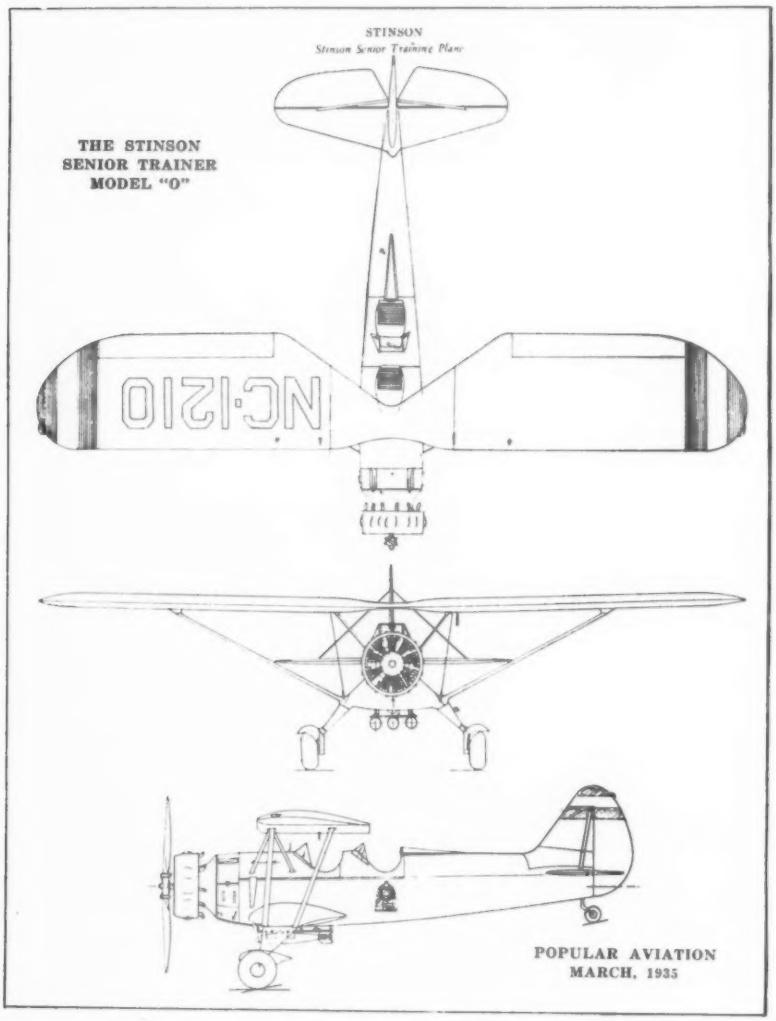
Plans of the Stinson Model "O"

STINSON Model "O" Senior training plane is manufactured by Stinson Aircraft Corporation for use by foreign nations. It is powered by a Lycoming 225 h.p. air-cooled radial engine. Provision has been made for a scarff gun ring to be mounted on the rear cockpit, and two machine guns of the normal service caliber are located in the nose of the ship. Bomb racks for the accommodation of several bomb combinations in weight, size, and destructibility are placed underneath the fuselage on a flat section conveniently made so by the design of the landing-gear.

This type of landing-gear is particularly well adapted for light military plane service when landing on rough ground for there is no axle or other low-lying part to catch on stumps, rocks or other obstructions found on emergency fields. There is plenty of clearance beneath the bomb racks for any ordinary condition that might be encountered.

The vision range is excellent in any direction, the deep cut-out in the wing giving perfect freedom upward from either the pilot's or gunner's cockpits. The elevation of the wing above the fuselage gives clear vision forward while there is practically no obstruction to the view in a downward direction. The fuselage is an adaption of the open-cockpit type commonly used as trainers.

Planes of this general type are becoming increasingly popular as a military arm for the smaller countries, and several major European countries are using this type for patrols, surveys and similar work where the initial cost and cost of operation are important factors. The various Breda planes employed by the Italian Air Corps are of this general type and have given very efficient service at low cost for fuel and maintenance. In South America, this type is employed extensively for many purposes.



Roumanian Fiesta

A PILOT recently returned from Roumania relates a story which shows how a fiesta made a runway for an airplane.

One winter, a factory demonstrator for an American airplane company ran out of gas over there and had to sit down. After landing safely and gassing up, he discovered that the snow was too deep and soft to permit taking off with his wheel-equipped ship. Not having any skis handy, he thought up a brilliant idea.

A crowd of peasants had surrounded the ship and he dispatched several of them to town for wine and an orchestra. When these items arrived, this keen-witted pilot threw a party for the crowd. They wined and danced—they danced vigorously in the Russian peasant style, squat-kicks and Russian stomps, up and down the field and around the airplane.

Within a very short time the snow was packed down hard, the pilot had a smooth runway and took off as the peasants raised a mighty cheer for this unexpected party-thrower from the sky.

High Notes

THERE was music in the air when two pilots at the Beaumont (Texas) municipal airport tried out a stunt new to that section of the country. Getting aboard a Taylor Cub, Larry Fisher, pilot-piano-accordionist, rode upstairs as a passenger. The pilot, Andy Gibson, cut the throttle at 1,000 feet and, with the Cub gliding over the airport, listeners heard the strains of "The Man on the Flying Trapeze" drifting down to them. No amplifying device was used but the piano-accordion music was heard clearly by the group on the ground.

Flying Post Office

A NEW and important bill has been presented to Congress which provides for the installation of pneumatic tube service at the municipal airports of St. Paul, Minneapolis, and New York.

With the mail sorted out in the plane and placed in the tube carrier cartridges, the letters will be rushed from the airports to the proper post office in these cities, thus saving the long delay experienced when the letters are delivered by truck from an outlying airport.

With such local pneumatic service, it would make it possible for a letter mailed in New York in the morning to be delivered in Chicago in the afternoon. The speed in the tubes is over 60 m.p.h. and the transfer is not delayed by traffic conditions existing at street level. Tubes of this general type have seen long service and are practicable. One postal tube line in Chicago has run for over 30 years.

All About Grudge Jumpers

by T. R. WISEMAN

Just one more interesting story concerning the traditions of the U.S. Army Air Corps and the manner in which parachute rigging is conducted. Photos by 126th Photo Section, 45th Division Aviation.

DID you know that until recently parachute packers and inspectors in the army dreaded an assignment to Randolph Field and the other cadet flying schools, because of the "grudge jumps"?

Most of us never heard of a "grudge jumper," but the 'chute riggers have and they resent the implication against their professional reputation much more than they dislike the wasted time involved in these jumps.

If a flyer suspects his parachute was packed by a rigger who dislikes him, an old rule in the army provided that the 'chute packer must jump with that parachute, himself. He, then—is a grudge jumper.

Because of this ruling, the flying school assignments were not popular. Flyers in these schools are all young and full of mischief. They liked to see the parachute jumps. It became a daily occurrence for cadets to complain (with no reason) that Packer So-and-so had a grouch and should be required to use the 'chute as proof of his good faith.

This situation interfered with efficiency and esprit de corps, and the order was rescinded. 'Chute packers are no longer subject to this trial by fire.

Among parachute packers, however, there is an honest belief that a 'chute inspector and rigger should be willing to use his own 'chute. They feel nothing can so impress a man with the great responsibility which rests upon his handiwork until his own life has been trusted to it.

After watching the tedious and intricate detail of a parachute inspection and packing, it is easy to understand this attitude. 'Chute packers are picked for their sense of responsibility and to them there is no sin so black as carelessness.

Meet Andy and Amos, the two parachute test dummies and their friend, a "grudge jumper." Amos and Andy have no heads at all which is a charge sometimes leveled against the whole fraternity.

Among other jobs arising from the development of aviation, the profession of parachute rigger has grown up during the last fifteen years. It requires detailed and intensive training and a patient carefulness of disposition much more important than the strict training these men receive.

One tiniest infraction of the stern exactness with which a 'chute must be packed to insure proper and speedy opening, may cause disaster to the flyer. That is why the temperament and general disposition of the 'chute rigger has so much to do with the confidence reposed in him by the squadron. A man of sullen, brooding disposition—prone to take too seriously his own personal feelings, or one with a hasty temper or a hot and changeable emotional nature, could ruin the morale of a flight squadron more quickly than the greatest actual danger.

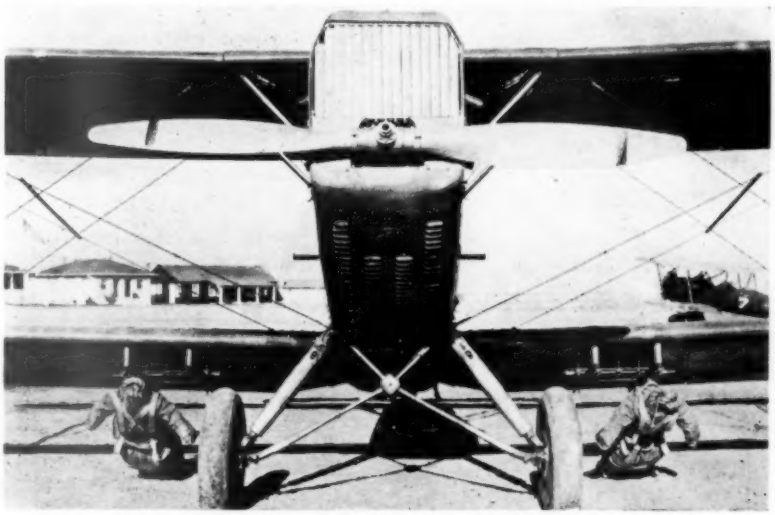
With this realization behind them, parachute inspectors and packers are careful to keep their own poise and morale at the highest possible standard. They do not attempt to pack and inspect parachutes unless their own personal reactions are normal. They never pack a 'chute when tired or hurried.

I watched Sergeant Charles West of the 120th Observation Squadron, Forty-Fifth Division Aviation, pack a parachute one day.

A long table is used for the work, and the harness, which fastens the 'chute pack to a man, is placed as it would be if he were lying face downward on the table, with the pack in its proper position on his back.

This harness is made of linen webbing straps which hold the pack in place and buckle around the body. There are several types of 'chutes—the seat pack, back pack, and the lap pack—all service types of 'chutes. In training a single harness, with double 'chute of both back and chest packs, is worn.

Minor repairs, if needed, are first made to the harness and pack carrier. Some of the stitches which hold the pack to the harness are always ripped when the 'chute opens. These must be



All set for a 'chute test with the dummies hooked to the bomb racks.

replaced before the pack parachute can be inspected and repacked. The canvas back-pad of this harness has a name and the field of the wearer printed across it, and a small pocket to hold the drop-test and inspection card. This card has notations of dates when the 'chute was drop-tested with a dummy.

Each parachute is aired on a rigging which permits the breeze to blow freely through the folds. Each triangular panel of this huge white silk umbrella is in four sections. There are twenty-four panels, each twelve feet long, cut on a forty-five-degree bias, in a twenty-four-foot 'chute.

The 'chute is stretched at one end of the long table with the harness at the other end and the suspension lines between. The pilot 'chute is examined first. This is a small square piece of silk which is opened and held rigid by a patented spring device. This spring opens as the rip-cord frees the pack and it catches the air, holding the large 'chute straight as it unrolls and the shroud lines from tangling until the larger parachute can fill with air.

The spring of this pilot 'chute is tested for action and the joints examined for loose pins, or rust. Each spot in the silk is rubbed and inspected closely to be sure no oil or acid is present.

In the foreign possessions of the United States, 'chutes must be inspected once a month instead of every sixty days. This is because all our army stations in foreign possessions are subject to the climates which have a great deal of salt water in the air. Salt water produces rust much more quickly than any other spot.

Joints of the spring are touched with oil and carefully wiped. You might say each joint was given a look at the oil on a little stick. The pilot is pushed shut and wrapped firmly in its own shroud lines until later.

Next, all lines are tested for strength and inspected for spots. The elastic of the circular vent in the top of the 'chute is tested and if stretched or weakened, it is replaced. This vent is made to stretch when the air first rushes into the 'chute, so as to save strain on the silk. When this first pressure is over the elastic draws up and keeps the air in the 'chute. This puckered vent is an eight-inch piece of silk, joined to the main 'chute at the apex.

The long shroud lines which run through seams in the parachute are fastened to the upper lateral band at the apex of the 'chute at one end and to the harness at the other end. These are anchored three times in the seam. Five inches of slack are allowed between anchorings because the shroud lines stretch under strain. This prevents tears in the silk.

Every section of the 'chute is examined for acid spots, rips in the seams or holes. Next the suspension lines are tested and examined. A single spot of acid on these lines might cause the line to rot while lying packed ready for use, resulting in disaster.

(Continued on page 193)

The New Speedy Douglas Observation Planes

(See front cover)

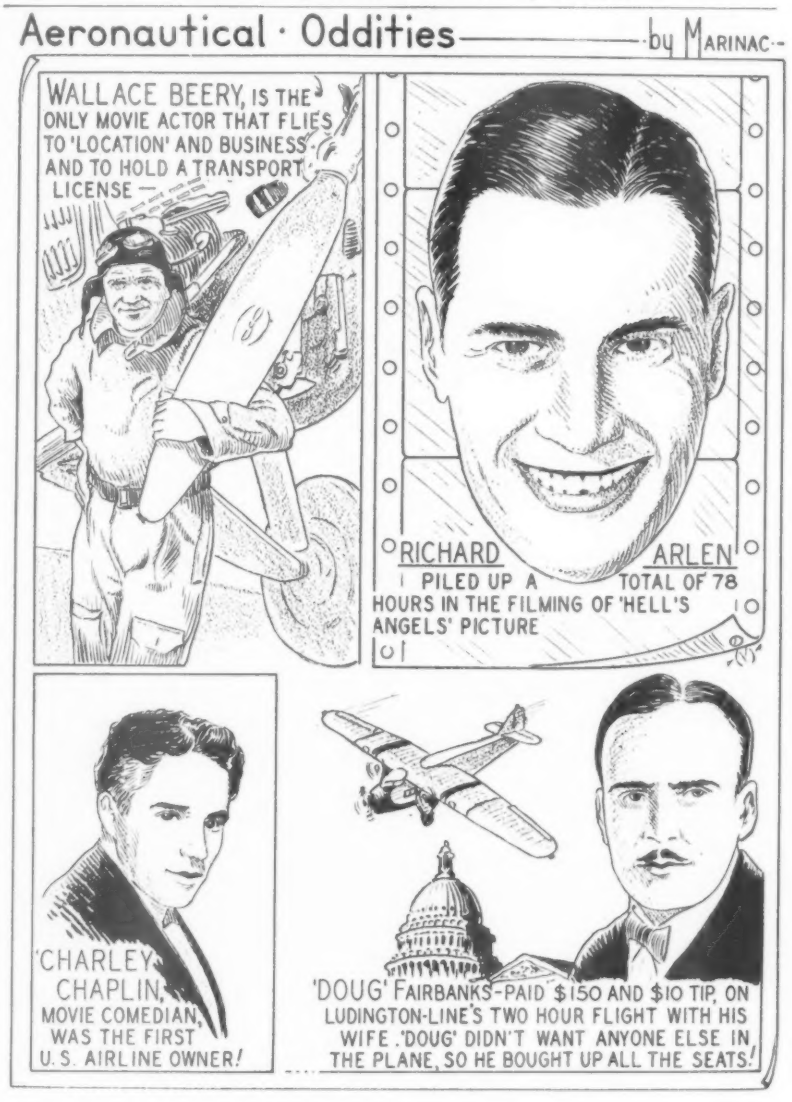
RECENTLY, the Douglas Aircraft Corporation, Santa Monica, Calif., was awarded a contract for seventy-one Type O-43A observation planes by the U.S. Army Air Corps.

The Douglas O-43A is said to be one of the fastest observation type planes yet designed, although no data is yet available on their performance. In all details, they are a marked improvement upon previous ships of this type. The first ship was delivered to the 22nd Observation Squadron, Brooks Field, Texas.

In general, this plane might be called a parasol monoplane for the reason that the wing is considerably elevated above the fuselage for better forward vision. The long tapering form of the fuselage rather reflects current British practice in streamline design. The tail-group is unique in the fact that the stabilizer is considerably elevated above the conventional position, being located some inches above the fuselage.

In the first experimental model, of which pictures have been published, there was a bulge or "blister" on the underside of the fuselage and just beneath the gunner's seat (rear seat). This blister was placed here to determine the advisability of increasing the depth of the fuselage at this compartment, but it was afterwards eliminated and the underside of the fuselage is now a smooth line as shown in the drawing on the front cover.

A study of the drawing will show that the visibility is excellent in all directions, the arrangement being greatly superior to that of other ships intended for this service. It is interesting to note the deep cut-away in the wing above the fuselage for upward vision and the complete elimination of any obstructions in the field of view below the compartments.


Aeronautical · Oddities
by MARINAC
WALLACE BEERY, IS THE ONLY MOVIE ACTOR THAT FLIES TO 'LOCATION' AND BUSINESS AND TO HOLD A TRANSPORT LICENSE —
RICHARD ARLEN PILED UP A TOTAL OF 78 HOURS IN THE FILMING OF 'HELL'S ANGELS' PICTURE
'CHARLEY' CHAPLIN, MOVIE COMEDIAN, WAS THE FIRST U.S. AIRLINE OWNER!
'DOUG' FAIRBANKS-PAID $150 AND $10 TIP, ON LUDINGTON-LINE'S TWO HOUR FLIGHT WITH HIS WIFE. 'DOUG' DIDN'T WANT ANYONE ELSE IN THE PLANE, SO HE BOUGHT UP ALL THE SEATS!

A New P & W Hornet Series

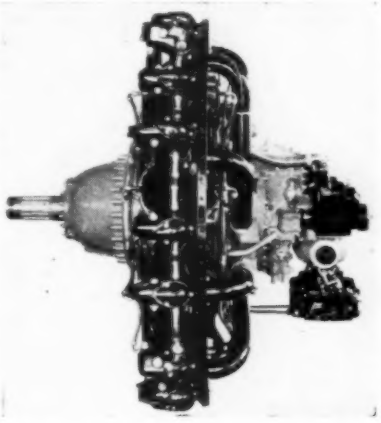
A new development in the Hornet engine series has just been announced by Pratt & Whitney. This supercharged and geared engine delivers 750 h.p. at 7,000 feet altitude and is the highest rated commercial engine now built.

THE "E" Hornet is a single-row nine-cylinder fixed radial powerplant rated at 750 horsepower at 7,000 feet. This geared and supercharged powerplant is the highest rated commercial engine of this type in the world.

Increased demand for greater horsepower output with a constant specific weight has spurred the production of the "E" series. The Pratt & Whitney engineers have been aided by the experience gained from thousands of hours of actual flight service which previous Hornet models have performed in military and commercial aviation both here and abroad during the past seven years. This experience, coupled with many new design features and improvements, has allowed them to create the "E" Hornet series.

The basic fundamental features which have contributed so largely to the success and outstanding performance of Hornet engines have not been changed. However, many new features, advantageous to performance and efficiency, have demonstrated through many hundreds of hours of dynamometer and flight-testing that the new Series "E" Hornet ranks with the new Series "H" Wasp as an outstanding development in the field of aeronautical engines during the current year.

The "E" Hornet, like the "H" Wasp, is equipped with automatic valve-gear lubrication, an ingenious device which improves starting, greatly reduces the wear of the valve gear, simplifies the servicing, and cuts the cost of maintenance both in the shop and in the field. Engine oil under pressure is fed to a distributing groove machined in the nose section of the engine and thence through metering ports to the valve-tappet mechanism. From the valve-tappet it is permitted to flow through the push-rod into the rocker arm and then is distributed to the various parts in the rocker box requiring lubrication.



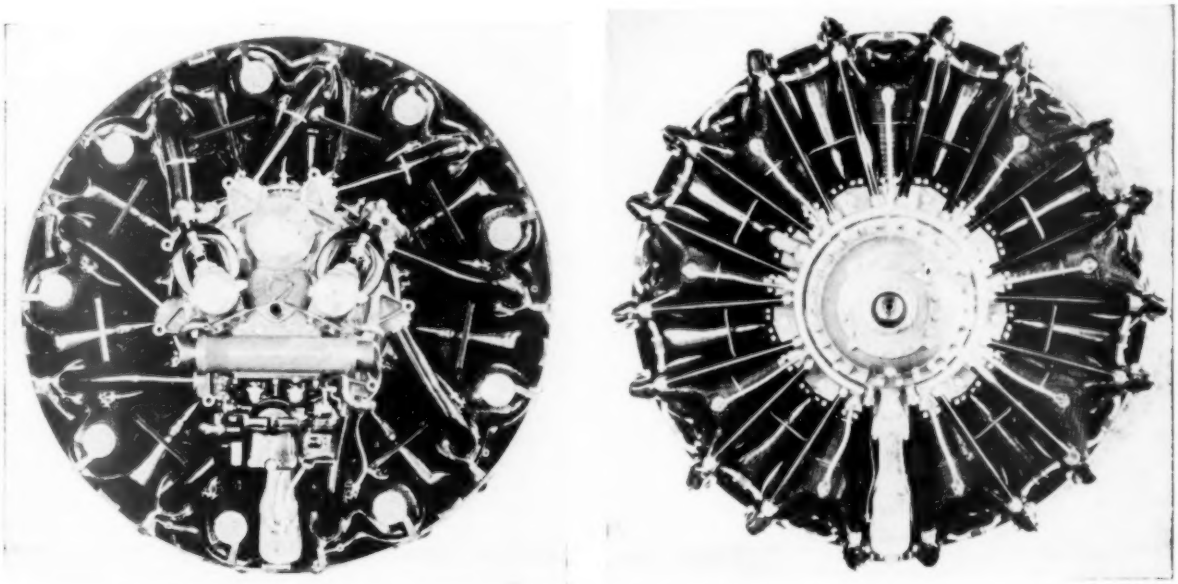
Side elevation of the Type "E" Hornet which develops 750 horsepower. Note the gear case at left.

After serving its purpose, the oil drains by gravity through the push-rod cover tubes to the crankcase or through a newly designed scavenging ring to a sump from where it is pumped back into the oil tank. By this means oil is not permitted to collect in the rocker boxes either in flight or after the engine is shut down. Consequently, the action of the valve gear is at all times normal, and starting, particularly in cold weather, is made much easier.

The "E" Hornet includes as standard equipment a thermostatic oil temperature regulator to be incorporated in the oil system of any airplane. This device automatically regulates the temperature of the oil entering the engine to about 68° C., thus relieving the pilot from manually controlling the oil temperature. It also reduces the warming-up period to about one-half its former time.

When starting or when the oil is cold the valve automatically directs the oil from the scavenging pumps to the bottom of the tank in close proximity to the suction line. Consequently the warm oil coming from the engine is drawn into the suction line feeding the engine and is used over again.

This process continues until the oil, entering the engine, approaches the desired temperature at which time the automatic valve begins to direct part of the oil through the oil cooler to the top of the tank and the suction line begins to draw from the main supply of oil in the tank as well as from the supply of hot oil coming from the engine. By this means the temperature of the oil entering the engine is automatically controlled and, in making it unnecessary to warm up the main body of oil



Rear view at left and front view at right of the new Pratt & Whitney Type "E" air-cooled engine. While this is a typical "Hornet," yet it has many refinements in detail.

in the tank before take-off, the warm-up time is considerably reduced.

Priming equipment is now an integral part of the engine. It is built into the carburetor and is accomplished by manipulating the throttle and mixture control levers in the cockpit. Thus, it is no longer necessary for the airplane manufacturer to provide for priming by bringing fuel-lines and pumps which invariably leak gasoline into the pilot's compartment.

The "E" Hornet is provided with an improved centrifugal supercharger with strengthened impeller drive parts. The drive is of such construction that the intermediate gears are supported on either side by precision type ball bearings. This feature increases the reliability of the gears and reduces the loads on the bearings. New diffuser passages increase the efficiency of the supercharger and provide more uniform distribution which results in improved engine performance, longer life of the valves, and reduced fuel consumption.

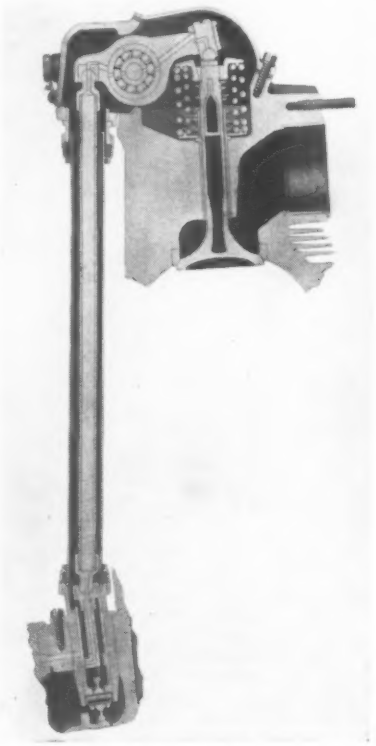
Probably the greatest step forward in the development of the "E" Hornet engine rests in the improved design and choice of materials in the cylinders and parts forming the combustion chambers. The cylinder is more rugged throughout and, by means of comparatively deep and closely spaced fins in combination with close-fitting baffles, satisfactory cooling with leaner mixtures is obtained. The barrel is manufactured from an improved alloy steel and is attached to the head in a manner which provides greater strength. It is ground with a converging taper at the top so as to allow for expansion and provide a straight-sided bore under normal running temperatures.

The demand for reduced fuel consumption has in part been met by improved valve design and valve-seat materials. Austenitic steel valve-seat inserts instead of bronze are shrunk into the cylinder heads. The exhaust valves are faced with stellite and as in other models are sodium cooled. The sodium chambers instead of being cylindrical are necked down to provide greater strength at the section where failure is most likely to occur. The head of the exhaust valve has also been redesigned to provide for greater flexibility and more uniform distribution of stress.

The pistons and rings are also more rugged and are designed for better cooling. Pressure baffles developed by the Pratt & Whitney Aircraft Company are independently supported on the cylinders by means of quick-detachable spring clips which add a measure of flexibility and durability unachieved in the past. A cylinder can now be removed without disturbing more than the adjacent baffles.

An entirely new cam and cam drive mechanism is provided in the "E" Hornet engine which permits the valve gear to be operated at higher speeds with the same degree of safety. The cam is mounted on and rotates about an annular pedestal or shoulder on the front face of the crankcase. This arrangement simplifies construction, reduces the angularity of the push-rods, provides an out-board bearing for the cam intermediate gear and adds greater strength to the crankcase.

A single-row two-piece crankshaft, split in the center of the pin, is one of the features of the "E" Hornet. The rear section of the shaft telescopes into the front half and is held in angular relation by an increased number of splines. The increase in the number of splines has added materially to the ruggedness of the shaft and has made the crankpin more nearly a homogenous unit.



Sectional view of rocker-box, push-rod and tappet showing improved method of pressure lubrication.

The crankshaft roller bearings have been improved by slightly crowning the rollers to prevent crushing the bearing races at the edges of the rollers. Although of the same type, the design of the reduction gear has been simplified considerably over the previous model. Greater precision in manufacture has made it possible to eliminate the previously used pinion gear equalizing mechanism without any sacrifice in reliability. The pinion gears are now supported on plain lead bronze bearings instead of needle bearings, an arrangement which also makes for simplicity.

The sump on the "E" Hornet is of new design adapted for use with the automatic rocker box lubrication system. The sump has an additional compartment into which the oil from the rocker boxes drains. This method of collecting the oil insures complete removal of oil from the boxes, thus facilitating starting and providing for smooth running. The control valve for the Hamilton Standard controllable-pitch propeller is on the rear face of the sump instead of on the nose section as in former models.

A new type hot-spot is part of the standard equipment of the "E" Hornet. Exhaust gases are passed through a stainless steel manifold cast in an aluminum housing. The heated streamlined tube passing through the center of the mixture passage produces excellent vaporization with low loss of power, thus adding to the efficiency of the engine. Because of its compactness this hot-spot facilitates the installation of a top air intake.

The paramount problem in engine design is the prevention of oil and grease leaks. Every effort has been made by Pratt & Whitney engineers to approach as near as possible, complete tightness in every detail. Additional thickness has been applied to the flanges on oil pipes, accessory covers and cover plates to prevent warping and the consequent leakage. Rubber inserts have been provided on cylinder flanges and between crankcase flanges to achieve the resulting oil tightness which is one of the features of the "E" Hornet. A one-piece push-rod cover with packing glands and nuts at each end eliminates the old two-piece type cover and aids toward the achievement of oil tightness.

SPECIFICATIONS OF SIE-G HORNET

Approved Type Certificate Number 136
Rating: 750 h.p. at 7,000 feet
Propeller Ratio: 3:2
Compression Ratio: 6.5:1
Blower Gear Ratio: 12:1
Overall Diameter: 54 7/16″
Overall Length: 51″
Bare Weight: 1,005 pounds

The accompanying sectional view of the valve mechanism shows how pressure-feed lubrication has been applied to this important engine element. Hollow and drilled push-rods, rocker arms, etc., permit the oil to flow freely and constantly to the various rubbing parts and pins so that adequate lubrication is had at all times while the engine is running.

Perfection, in what may appear as minor details, contributes to the reliability and life of the engine. In commercial service it goes almost without saying, that such items keep the ship flying, reduce the cost of maintenance and the labor required in making repairs. In days of rigid economy and competition, these are elements known on the ledgers of the operating companies.

Thorough lubrication, with the lubricating oil going positively and constantly to every rubbing part, a uniform and unvarying gasoline-air mixture, prevention of oil and grease leakage, effective cooling and tight, hard valve seats, go a long way to insure reliable operation and freedom from wear.

A New Emergency Squadron

by MARJORIE DRISCOLL

A new women's aeronautical organization has been founded to assist the authorities in the case of emergencies such as floods. It is organized along military lines and shows great possibilities for the future.

FLOOD waters, from storms or the sudden breaking of a dam, have swept down, leaving devastation behind.

Marooned on a few acres of high ground are a score of refugees, cut off from rescue by spreading waters or washed-out roads. To reach them on foot would take hours; perhaps days. By that time, the injured might be dead. Others might be victims of pneumonia.

An airplane circles overhead, piloted by a woman in a blue uniform. If there is space for any kind of a landing, she sets her plane down. Other women, also in uniform, climb out. They carry well-supplied first-aid kits. They lift out a portable radio.

Within an hour, the sick and injured have been treated by trained nurses and first-aid workers, and the pilot is in radio communication with an airport base. The Medical Detachment of the Women's Air Reserve is on the job.

Or, perhaps, there has been no room to land. Then the plane circles slowly back over the watching refugees. A blue-uniformed woman steps overboard. She is a professional parachute-jumper, possibly Mary Wiggins, nationally-known stunt girl.

In a shoulder pack, she carries a first-aid kit, and a miniature but efficient radio outfit is attached to her belt. On the ground, she becomes nurse, first-aid worker, and radio operator, all in one. After a while, in answer to her message, another woman-piloted plane appears and freight parachutes come drifting down, bringing supplies.

This is the service which this group of flying women doctors, nurses, and first-aid workers has set as its standard of efficiency. The Medical Detachment of the Women's Air Reserve, centering in Los Angeles, is an especially trained group within the main organization and is under the command of Lieutenant Viola Neill, R.N. The Women's Air Reserve has found favorable recognition by the American Red Cross and the aerial squadron of the Los Angeles county sheriff's office, and is scheduled to work with them under the set-up of the "Sheriff's Disaster Program."

Their activity includes regular training, with drills, practice flights, and the study of theoretical problems, and in addition a constant effort to build up equipment. Some of the members own planes; others have ships available at need. They have the use of a well-equipped ambulance plane. First-aid equipment, radio outfits and other necessities are being assembled, but much of the material is expensive.

The Medical Detachment is strictly a working group. At five regular meetings every month, the women study and drill. Often they undertake special activities.

Litter drill, Medical Detachment, Women's Air Reserve. LEFT TO RIGHT: Viola Neill, Mary Wiggins, Patty Willis, Ruth Van, Dr. Emma Kittredge, Alice Jane Kelly, Bobby Trout, Josephine O'Connell, Bee Selck.

Following the flood of New Year's Eve, 1933—in which, incidentally, Lieutenant Vivienne Culver, R.N., a Reserve member, headed the first relief hospital — they conducted a special maneuver. The orders read:

"Assemble at the Alhambra Airport. Take a map of the flood area. Fly over the area, marking on the map washed-out roads, broken bridges, etc. Locate and mark on the map the position of a man on the ground, waving a red flag to indicate that he represents a 'patient' in need of aid. His position in the area will not be previously known to you. From the air, map a ground course by which the 'patient' may be reached. Return to the airport, take your car, and find the 'patient.' He will hand you a list of 'victims' and their injuries. Prepare to treat these persons and to arrange for their transfer to hospitals."

At recent air meets in Los Angeles and neighboring cities, the women of the Medical Detachment have given demonstrations of litter drills; have set up and managed emergency hospitals, and have efficiently rendered aid when called upon.

At the National Air Races in Los Angeles in 1933, the Women's Air Reserve had charge of the emergency hospital, the first-aid and public clinics. They handled over 130 cases, without the loss of a life. One of their patients was Hoot Gibson, film actor, who was injured when he crashed during a race.

The Medical Detachment of the Women's Air Reserve was made a separate unit when the Commanding General Florence Lowe Barnes, noted speed flyer, assigned Lieutenant Viola Neill, R.N., to proceed with the training of the unit as its chief.

In building up the unit, Miss Neill worked carefully. She found several women pilots in the Reserve who were trained nurses; some who had Red Cross first-aid certificates. She induced a few carefully selected nurses to learn to fly and to join the unit.

Dr. Emma Kittredge of the staff of the California Hospital and Flight Surgeon of the Reserve aided her greatly. Dr. Kittredge is an examining physician for the aeronautical bureau of the Department of Commerce; the only woman to hold such an appointment. Her work for the government is particularly for the help of women pilots and their medical problems.

Dr. Kittredge, with members of the Medical Detachment as her subjects, is now making a special study of the effect of flying on the physical and nervous systems of women. She examines them before and after flights; they observe their own reactions and report to her. She is gathering a mass of data that promises to be of great value to aviation medicine.

The drills which the women undergo are in charge of a sergeant from the 160th Infantry, California National Guard, and follow the manual used by the Army Medical Corps. The Reserve is a military organization, patterned after the Army Air Corps, not with the idea of transforming the women into

(Concluded on page 194)

The Ford Globe of Interest

The Ford Globe and Plane

AN unusual impression of the spectacular London-to-Melbourne air race is given by this "Ford Globe," the largest globe ever built.

This globe forms the background for a model of the United Air Lines "247-D" transport used by the American team of Pangborn and Turner. The model is shown suspended over the Timor Sea, the last stage in this historic flight.

Kontact Klub

DAN P. GRAFFLIN, or William C. Brooks, of the old Gates Flying Circus. I wish to settle an argument with a friend over information in the last issue of POPULAR AVIATION.—Ray Grace, 265 Goodwin St., Perth Amboy, N. J.

JEFF WARREN—HAROLD SPEER—somewhere out West. If you remember your "star student," drop him a line. I expect to be on the Coast selling ships in the spring.—Harmon Lane, Albany, Ga.

CLEVELAND, OHIO—OR VICINITY. I desire to get in touch with someone owning a plane in the vicinity of Cleveland, Ohio, who would be willing to fly me in their plane on week-ends or Sundays if I bought the gasoline and oil.—Wm. J. Palek, 3527 East 138th St., Cleveland, Ohio.

WILLIS E. KYSOR, please send me your complete address. Would like to know more about the Rasmussen Special that you flew in the 1934 National Air Races and also give price of the blue prints.—Joe Albanese, 250 West 23rd Place, Chicago, Ill.

LIEUT. WALTER M. BLANSKI, formerly of Milwaukee, Wis. I would like to get in touch with you as soon as possible. Have a business proposition on hand to offer you. Please let me know where you are. Get in touch with me immediately.—Emilie B. Folkush, 1621 N. 17th St., Milwaukee, Wis.

GEORGE F. FREID—ADOLPH LISKA—EDWARD PREZEBAR, who attended A.S.T., should see this. Let's hear of your whereabouts, also what you are doing.—Vincent Alekna, 627 West 18th St., Chicago, Ill.

CHINESE PILOTS and student flyers. Would like to get in touch with all Chinese pilots in the United States and China. Can send replies either in Chinese or English.—Leung-Ah-Luck, 506 Copernicus Ave., Gretna, La.

COLEMAN J. ARTHUR, Brooklyn, N. Y. Do you remember the crash of the two Chinese youths who staged a dog-fight over Brooklyn last summer? Can you obtain the address of the man who came safely from the mid-air collision? Please let me know at once.—Leung-Ah-Luck, 506 Copernicus Ave., Gretna, La.

U.S. Naval Squadron Insignia

(See back cover)

ON the back cover of this issue is a highly interesting collection of U.S. Naval squadron insignia in full colors. This will prove of great interest to both our model builders and Photo-Phans who have made many requests for this identification data.

Before proceeding with a description of the insignia, however, we wish to thank the Navy Department, Bureau of Aeronautics, for their kind assistance in helping us prepare this page. Certain insignia have been described in the Naval pamphlets, while other material was prepared specially for this work.

The insignia of VO Squadron Nine-M (VO-9M) is the "flying eye." It depicts "going places and seeing things" which, of course, is the basic principle of an observation squadron.

At Pensacola, where both primary and advanced flying instruction is given, they have chosen a goose for their insignia, the insignia showing a goose making a stall landing on the water. The goose is associated with foolishness and amusement, the silly expression on the face of the goose indicating lack of skill and uncertainty and also the pleasure of making a landing while all in one piece.

The heavier-than-air unit of the U.S.S. Macon has adopted a burly acrobat as their insignia, which might be the celebrated "young man on the flying trapeze." The acrobat denotes the dirigible grasping the hands of a fellow performer just as the small service planes are grasped by the hook of the dirigible when landing on or taking off from the Macon.

Now, the aviation unit of the U.S.S. Houston, Asiatic Fleet, is highly significant. It comprises a Chinese character which signifies "a bird that can fly." We hope that this is not confused with the symbols of the real Chinese Air Force which might possibly be in the vicinity of the Houston. They tell us that there are about sixty different pronunciations for this Chinese symbol, but that the Shanghai dialect has been chosen which pronounces it "Na Yor." And Na Yor to you—also.

"Felix the Cat" carrying a bomb is the insignia of the Fighting Plane Squadron Six (VF-6), this being adopted at the time that this squadron was a dive-bombing unit. Its mission at present is simply that of a fighting unit, but the old symbol has been retained nevertheless.

Then we come to another member of the menagerie, the elephant insignia of Patrol Squadron One (VP-1). The elephant stands on a cloud ready to drop a bomb when the proper time comes, cocking his eye downward for a direct hit. The elephant has always been noted for his strength and patience, two of the elements that are appropriate to a patrol squadron.

Fighting Plane Squadron Two (VF-2) is built up largely of enlisted pilots. Their insignia is in the form of a chief petty officer's chevron with an eagle. At the base is the word "Adorimini," which when translated means, "Up and at 'em." This Latin word was used by Caesar's legions as a battle cry.

The "flying eight ball" is employed by Patrol Squadron Eight (VP-8) which was, so they say, inspired by a pool game. In this particular game, the accidental dropping of the eight ball in a pocket loses the game for the unlucky bungler, hence the insignia infers that the eight ball is the last to drop and it is dangerous to play with.

A shining sun with a flying wild goose below it is the trade-mark of Patrol Squadron Nine (VP-9). The wild goose patrols vast territories in his migratory flights, therefore he well represents a patrol squadron. He also flies with unerring judgment to his destination with great speed and flies in "Vee" formation similar to certain tactical flights of the patrol planes in bombing, towing, etc.

This naval insignia may have a background of heraldry, although this subject does not need deep study in order to appreciate and understand the significance of the various symbols which have been adopted and reproduced on the fuselage of the planes in the various squadrons of the United States Navy.

The whole practice originated during the World War when it became imperative that definite distinguishing marks were necessary on the airplanes to prevent serious mistakes being made during periods of low visibility. This need brought forth the use of the Iron Cross insignia on the German planes and the tricolored circle on the aircraft of the Allied forces.

As the activities and number of planes increased, the squadrons replaced the individual flyers, and as the pride in squadron organization grew as the victories of the squadrons mounted up, there came a strong desire by the members of these units to be distinguished from the other units or squadrons, and then the competitive spirit entered into the insignia requirements. The total result was the formulation of squadron insignia.

Because of the high spirits of the squadron members, most of whom were very young men, the majority of the squadron insignia were of a humorous nature or had a challenging motif. They were characteristic of youth and daring, being in some cases, reproductions of characters in comic strips or popular slang phrases.

This custom of the wartime was retained after the War by the various military aviation services of the United States, but it was not until aviation went to sea with the fleet that squadron insignia was almost universally adopted in the United States Navy.

A Novel All-Wing Airplane

by RAOUL J. HOFFMAN

A description of a "Flying-Wing" designed and constructed by the author. The new ship, which by the way is the second of this type to be built by the writer, presents many novel features.

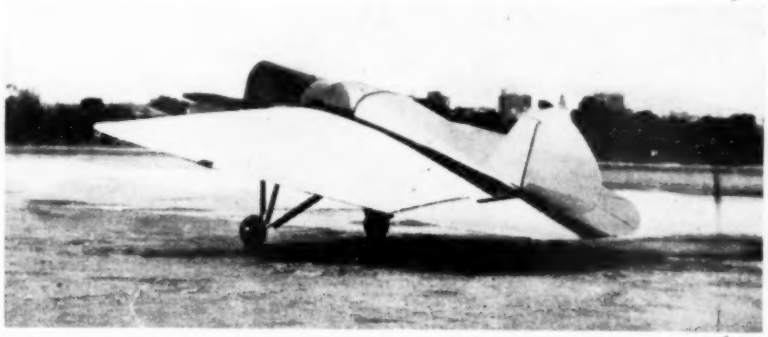
THE all-wing airplane built in St. Petersburg, Florida, for Mr. J. Leslie Younghusband of Chicago, as a low aspect-ratio flying wing, has a span of 22′ 8″, a maximum chord of 14′ 6″, and a total wing area of 237 sq. ft., including the center section.

The weight empty is 900 lbs., which may be reduced by more detailed designing. The center section, the fin, and the rudder are of welded steel tubing, the rest is of spruce while the covering is of fabric.

Three spars are used, with double drag trussing in each bay, giving the machine an extra rigid construction. The center spar has a depth of 20 inches. The wing sections used are of the M6 type, with M1 at the tip and extended M6 at the center.

The landing-gear is retractable with 16 x 7 x 3 airwheels, but the tests have been conducted with a rigid landing-gear, all recesses being covered. The seats are side-by-side, dual controls and individual stabilizer adjustment.

The twin elevators have push and pull connections and the tip ailerons



Side elevation of the new all-wing plane showing the arrangement of the main lifting surface.

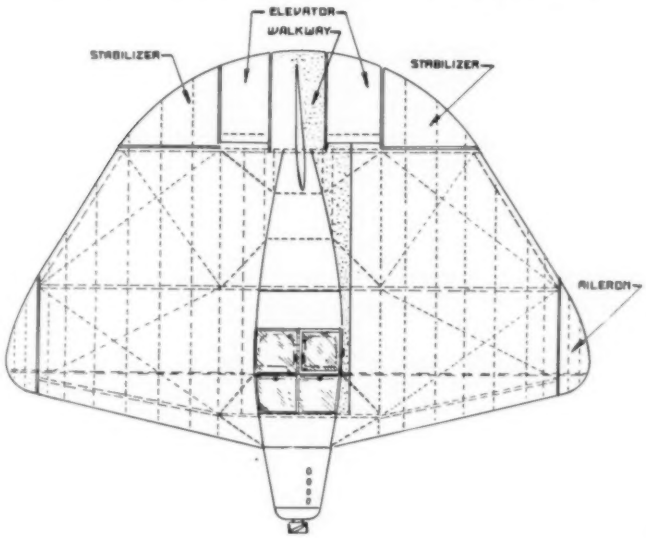
are operated with a torque tube. The power-plant is an 85 h.p. English Cirrus with a 7′ 0″ diameter propeller having a 4′ 4″ pitch. A Ford fuel pump insures a positive feed in any position.

The cooling baffles have been designed in accordance with the latest laboratory tests. The tank has a capacity of 16 gallons. The entrance to the cabin is over the top of the wing.

The flight tests have shown the remarkable characteristics of an all-wing airplane not encountered with a standard airplane.

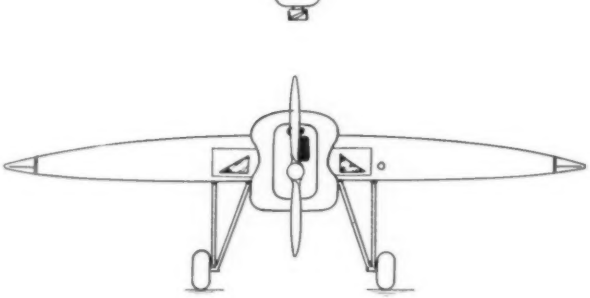
The top speed is 135 m.p.h., the take-off speed 30 m.p.h., and the landing speed 28 m.p.h. The landing at stall angle is steep and just before the wheels touch the ground, the machine goes into a flattened glide. This behavior is attributed to the positive rake

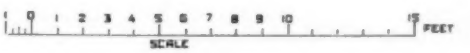
(Concluded on page 196)

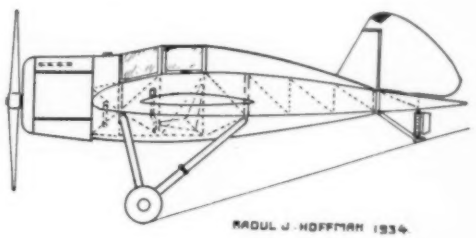


~HOFFMAN FLYING WING~
SPECIFICATIONS

WEIGHT EMPTY	900 LBS
SPAN	22'-8"
OVERALL LENGTH	17'-8"
MAX CHORD	14'-0"
WINGSECTION M1 AT TIP, M6 AT STABILIZER, EXTENDED M6 AT CENTER	
AREA	237 SQ.FT.
POWERPLANT	85 BHP ENGLISH CIRRUS
PROPELLER	7'-0" DIA. 4'-4" PITCH
TWO SEATER, DUAL CONTROL. RETRACTABLE LANDING GEAR	
ENTRANCE OVER THE WING	
INDIVIDUAL STABILIZER ADJUSTMENT	
CENTER SECTION WELDED STEEL TUBING	
OUTER SECTION WOOD, THREE BEAMS	
LANDING SPEED	28 MPH
TAKE-OFF SPEED	30 MPH
TOP SPEED, FIXED LANDING GEAR	135 MPH







Two New Dream-Ships Entered

DREAM-SHIPS are of three types: (1) possible, (2) impossible and (3) maybe so. But however that may be, we'll pass no criticism on the present exhibit but will leave that entirely up to our readers.

At the top we have the design of Mr. H. P. McLakid who has submitted a gull-winged ship with hardly a a straight line in it. Obviously it belongs to that ever-popular type of plane known as a "pursuit plane" which seems to be pursuing our dreamers more tenaciously and consistently than any other type of ship. The gulling of the gull wings is exceedingly deep and we would not care to stock so many sizes of ribs for replacements, but outside of that, it is a very creditable job.

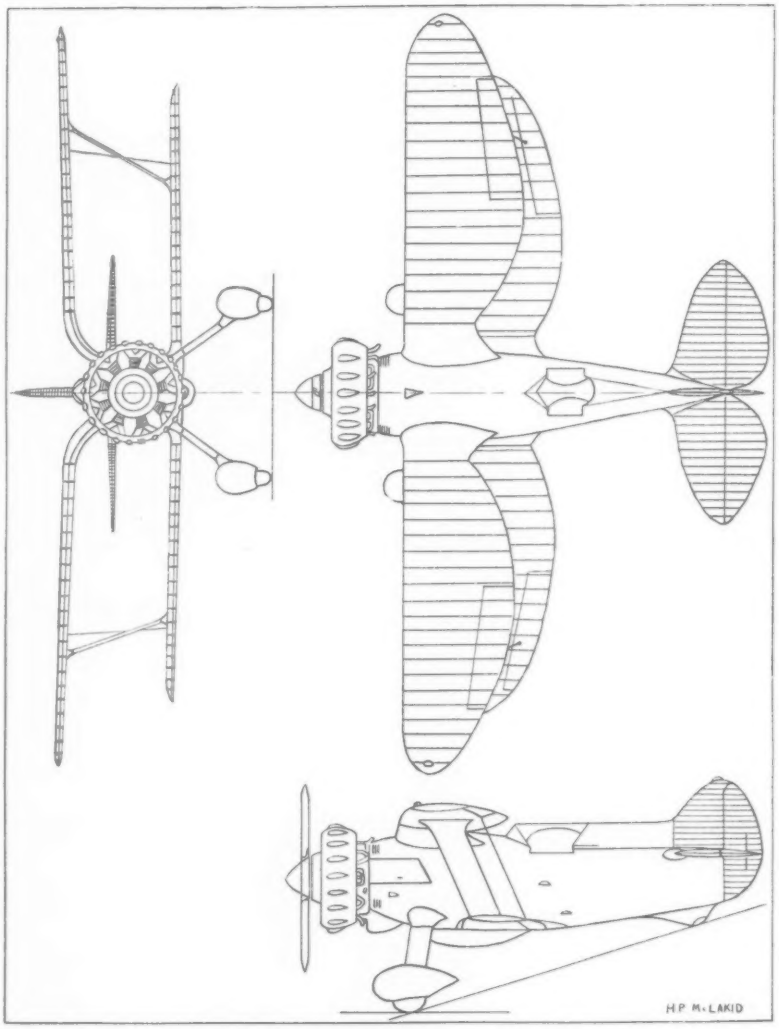
Leaving the plan view for the moment and taking a look at the side elevation, we see that Mr. McLakid's dream is equipped with all of the latest in aviation and that it somewhat resembles several of the Bristol products, particularly near the front. Some Gee-Bee suggestions hang around the tail end so that it is rather difficult to exactly define the order of architecture that the job follows. Thank you, Mr. McLakid, for your kindness.

And now we go down to the speedster designed by Mr. R. E. Fawcette which is labeled, "Coastal Defense Unit 2." This ship is literally bristling with armament with machine guns squirting out from every point of vantage, both front and rear. We call particular attention to the tail gun which must get all clogged up when the ship lands in clay or mud, but on second thought, perhaps he has it fixed so that it is corked up on landing by means of some automatic dooflicker.

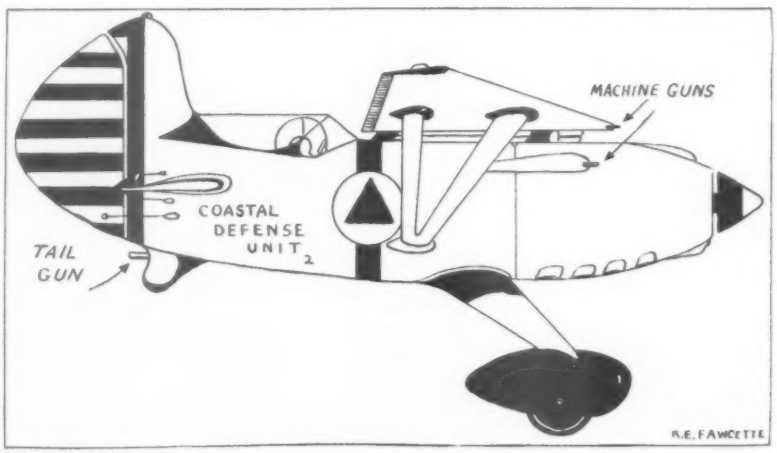
Somehow, this ship has more of a racing than military atmosphere and would be more appropriate for scooting around pylons than roaring over the front-line trenches. Employed as a racer, all of the guns could be brought to bear upon the referee and race committee which would sure be an advantage to the pilot in case of a disagreement.

And so they go. We have a tremendous batch of dreams and dream-ships on hand, more dreams than would be produced in a large hotel. In fact we are despairing of ever catching up with the flood of ships being submitted daily. It would take about two magazines, the size of POPULAR AVIATION, to hold the monthly inflow of sketches and specifications submitted by our readers.

For this reason, we will ask our readers to kindly hold back any ideas that they may have for a time until we catch our breath and use up a part of the material that we already have on hand. We hate to send back many fine drawings to our readers.



This is the favored dream of Mr. McLakid.



This fierce-looking pursuit ship is armed to the teeth. Mr. R. E. Fawcette is responsible for the design.

First Wright Plane May Return

by CHARLES J. BAUER

Plans are now being made to return the original Wright plane, which now is resting in a British museum, to the land of its birth.

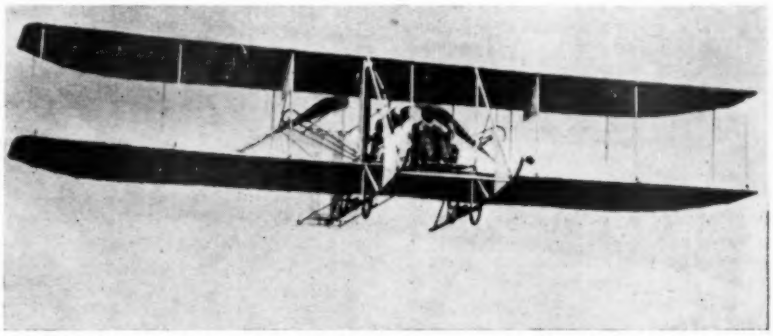
WITHIN hail of the prairie on which the Wright brothers perfected their achievement of the year before, when man first flew on the sand dunes of Kittihawk, North Carolina, workmen at Wright Field are completing a building intended as the permanent shrine of the airplane in which they made that first flight.

And when, early next year, Orville Wright is the central figure in the dedication of the $203,979 structure, prominent citizens of nearby Dayton expect to hear from the inventor that the plane will repose within the domed rotunda.

Regarded now, in the perspective of three decades, as the most important specimen in the development of aviation, the craft reposes in the South Kensington museum in London, England. Eight years ago Wright allowed it to be sent abroad, providing that he might reclaim it at any time after five years.

With this option in mind the Smithsonian Institution in Washington has sought no less than four times, as recently as this year, to add the plane as a priceless link in its marvelous and otherwise complete collection of things aeronautical. But Wright has resisted the overtures of the Institution, to which he offered the plane originally, because of an alleged unwillingness on its part to give himself and his late brother, Wilbur, due credit for their achievement in being the first men to fly a heavier-than-air craft.

That first flight, made at Kittihawk, Dec. 17, 1903, by Orville, was followed the same day by three others, the last and longest by Wilbur. Then, when the brothers and their six observers were comparing notes excitedly, the wind that made their flight possible lifted the half-ton craft and wrecked it so that it has not been flown since.



An old Wright Model "B" plane flown at a recent celebration of the Wright Brothers' first flight. The old ship is still able to navigate after years in storage.

Marshall Reid, an old Wright pilot, who flew the ship.

In this $203,979 Technical Data building at Wright Field Air Corps officials have included a rotunda in which they hope to place the original Wright plane.

It is this first plane, brought back to the Wright bicycle shop at Dayton, where it had been built, that is attracting attention again to the argument as to who deserves credit for the conquest of the air. Were Samuel Pierpont Langley, a former secretary of the Smithsonian, alive, the controversy might retain a personal aspect, but Langley died, his friends said of a broken heart, in 1906.

While the Wrights were building their gliders and first powered craft, Langley was making similar efforts toward successful flight. But where the Wrights were handicapped by limited finances, Langley was supported by a government appropriation. Despite this, his tandem monoplane failed in its two official attempts at launching from the roof of a houseboat in the Potomac river, the second failure occurring just nine days before Kittihawk.

The press was merciless in its treatment of Langley, notwithstanding the really high place history accords him as a pioneer in aviation. In fact, his plane, modified somewhat, actually did fly, but not until eight years after its inventor's death. Glenn H. Curtiss, opponent of the Wright brothers in important patent litigation, directed that flight at Hammondsport, N. Y., with Edward Doherty at the controls. Langley received no additional subsidy and even if he could have proved his craft airworthy, it would have been too late: the Wright brothers had their Kittihawk before the press was through poking fun at him.

Wilbur Wright died in 1912, but his brother never forgot that when the Smithsonian in 1910 requested one of the Wright planes, they suggested they could furnish the original. In answer they received a request for their 1908 machine and a quarter-size model of the 1903 craft. Since he regarded the Smithsonian as the only suitable place in this country for the first plane,

and he remained unconvinced that its directors were disposed to correct their error, he did not relinquish the souvenir at all until 1927.

And now that same plane, brought back the first time in wreckage years before the world accepted that the Wrights had uncovered the secret of successful flight, is expected to be returned to Dayton again, as the central exhibit of a laboratory-museum developed by the air corps at the field bearing the inventors' name.

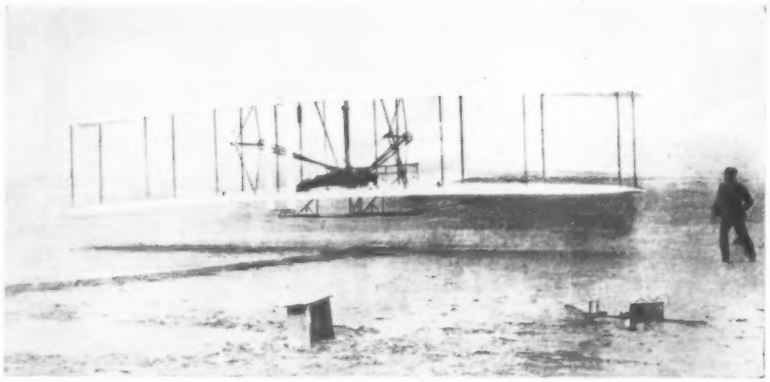
It is hoped to be enshrined in a fine glass case in the rotunda of the technical data building, nearing completion by the Gilmore-Carmichael-Olson Co. of Chicago. Centered in the dome-capped two-story area, the historic craft may be viewed from an octagonal balcony at mezzanine level. This rotunda is 43½ feet square, with walls of flexible wood veneer, floor of terrazo, bordered by a marble base, and a ceiling of ornamental plaster.

At second-floor level, to the right as one enters, is the document room, with the library immediately below. To the left is the statistical and drawing room, directly above the general offices. Between the portico and the rotunda is a foyer, and above that a conference room.

The basement is divided into workshops, a photographic projection room, printing rooms, and a portrait room. The main portions of the first and second floors are to be devoted to aeronautical displays, some of historic significance alone, others of definite research value, for the institution already conforms to the specifications of Orville Wright when he wrote in 1925:

"I have wanted the plane to go to a museum which has an educational exhibit of aeronautics and not to a museum where it would be merely a curiosity. The Smithsonian is the only institution in America which has such an exhibit."

At the time that was true; the army air corps technical data branch had not yet developed its laboratory-museum. In the hands of Capt. D. M. Reeves, head of technical data, the development was no more, at first, than a corner in the administration building for some obsolete equipment, but useful for research. As the displays became crowded, Capt. Reeves obtained additional space and only this year the museum was enlarged by several thousand square feet of floor space.



The first human flight in a powered airplane. Orville Wright is at the controls with Wilbur running beside the plane. Dec. 17, 1903, Kittihawk, N. C.

In connection, Capt. Reeves and his assistants have developed an extensive bibliography, and displays are keyed to books and documents in the field library. However, for lack of space much of the material that will find a place in the new building has remained packed away. So in the relatively few years that the Wright plane has been in exile, the army air corps has drawn on its vast resources to build up an aeronautical library-laboratory-museum second not even to that of the Smithsonian.

Pending completion of the Wright structure, the laboratory-museum occupies a portion of the huge administration building, 100 yards to the south. Here an area has been cleared for construction of what will be another important display in the new building.

Under direction of Orville Wright, who provided specifications from original records, an exact replica of the Wright glider used at Kittihawk is being completed. Built of spruce, it is a faithful copy, even to the kind of hardware fastenings, of the Wright glider of 1902, the last they flew before they turned, the following year, to the problem of powered flight. The value of the replica is apparent when it is understood that the original is no longer in existence.

The rebuilding of this glider by the army air corps under Wright's direction for a place in the new building is significant, one may believe, of Wright's eventual decision as to the disposition of his first plane. The glider, representing as it does the conquest of the problem of stability by the Wrights, would become a significant sister exhibit beside the original powered craft.

Specifications of the glider furnished army air corps technicians by Wright are: 305 square feet wing area; span, 32 feet; chord, five feet; front elevator, 15 square feet; rigid surface astern, six square feet; net weight, 116½ pounds. The craft is the third of the gliders in which the Wrights experimented at Kittihawk. It incorporated improvements suggested by the experiments of Octave Chanute and by Chanute himself, who gave them helpful advice. Among these improvements was advancing the main cross piece of the frame to the extreme front edge of the wings, encasing all cross pieces and ribs in the cloth of the surface, and rearranging all the bracing wires so they might be tightened by shortening two of them.

During September and October of 1902 the brothers made between 700 and 1,000 glides from Kill Devil hill. in a bad backward crash from 30 feet, Orville was injured, not seriously, Sept. 23. These glides marked the end of one phase of their years of careful study in which they avoided premature attempts to install an engine. Then only did they turn to powered flight, which they achieved the following winter.

In large part, historians agree, the anxiety of the Wright brothers to solve the pressing problems of stability for gliders before tackling the entire ques-

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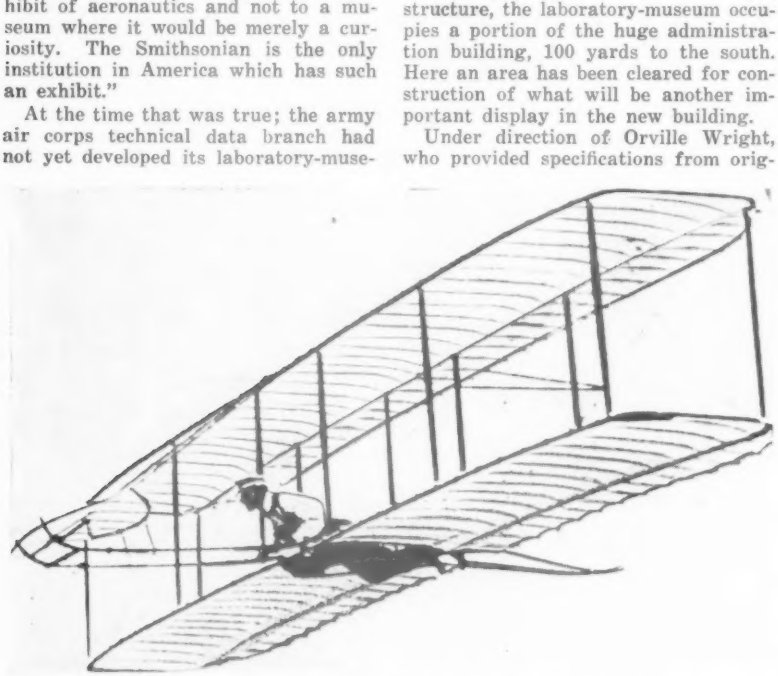


Wright glider of 1902 in flight at Kittihawk, now being rebuilt at Wright Field under Orville Wright's directions.

Elements of the Propeller

by J. D. VAN VLIET

This is the second article treating on the basic principles of the air-screw, in which simplified calculations are employed for the novice.

BEFORE proceeding with the actual layout of a propeller, we shall consider some of the factors which may affect its design.

There is nothing in engineering more conducive to failure than to apply indiscriminately a so-called "working formula," without first having made one's self thoroughly conversant with all conditions bearing on the problem which are not implied by the formula itself. The first question to consider is: *At what speed is the propeller to have its maximum efficiency?*

A propeller may be designed for the maximum speed of which a plane is capable with the horsepower available and may possess its maximum efficiency at this speed; yet, from an economic standpoint this solution may not be acceptable, for the maximum speed will not be the most economical speed in point of mileage flown for the amount of fuel consumed.

On the other hand, a propeller designed for a good cruising speed will hardly be suitable for maximum speed; in fact maximum speed could not be obtained with this propeller on account of the decrease in efficiency attendant to the increased rotational and forward speed.

Again, a propeller satisfying any of the above conditions may not be suitable when a maximum rate of climb is desired; and when this latter condition is met, it may be found that the plane is deficient in angle of climb, which would adversely affect the take-off. Therefore, a propeller with fixed blades designed to have maximum efficiency for any one of the above-named conditions is bound to show less efficiency for any of the other conditions; it follows that a propeller designed for the best all-around performance must needs represent a compromise in which maximum efficiency is not the criterion for any one of the different performance requirements.

In order to make this clear we shall consider three variations of propeller performance, namely (1) that of a propeller designed for maximum efficiency at maximum speed, (2) that of a propeller designed for maximum efficiency at cruising speed of the same plane, and (3) the performance of the first propeller at cruising speed.

The examples are also intended to show that the mere application of a "working formula" does not automatically lead to a satisfactory solution of the problem.

The chart in Fig. 1 gives the horsepower required and horsepower available curves for a plane having a maximum speed of 120 m.p.h. with a 200 h.p. motor actuating a propeller at 2,000 r.p.m., the propeller at this speed showing a maximum efficiency of 80%.

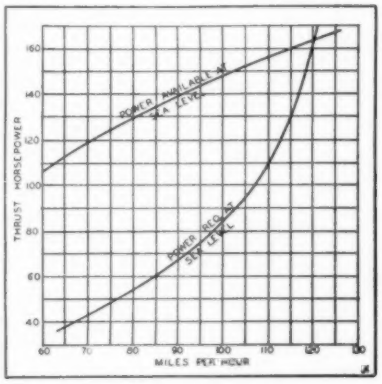


Fig. 1. Chart showing the relation between airplane speed and thrust horsepower.

We do not mean to imply that 80% is the maximum efficiency for any propeller, for the efficiency of some propellers runs higher than that; the figure has merely been adopted for the purpose of illustration.

In our plane then, the horsepower delivered by the propeller, or the *thrust-horsepower*, is $.80 \times 200 = 160$ h.p.

The reader has the choice of figuring the diameter of the propeller by using any of the various formulas available; the Air-Service formula given in the previous article gives satisfactory results which are confirmed by the nomographic chart published by the same authorities. The diameter thus found will closely correspond to that given by the simpler, semi-empirical formula:

$$D = \sqrt[4]{(K^2/RPM)^3} \times B.H.P./V$$

in which V is the plane speed in miles per hour, while a good average value for K^2 is 90,000. In our case, to which this formula applies, the propeller is a two-bladed one.

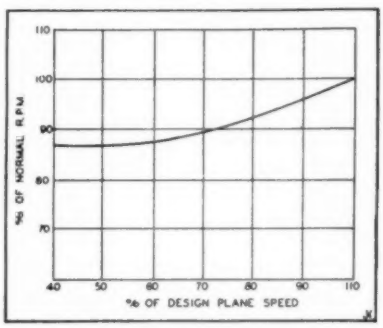


Fig. 2. Percent of design speed plotted against percent of normal r.p.m.

The diameter then works out to 6.8 feet or 6′ 9½″. This diameter should not be considered as final, for it may have to be modified later for reasons which will become apparent. The value 6.8 ft. however gives us a starting point. The V/nD then is $(120 \times 88)/(2{,}000 \times 6.8) = 0.776$.

Since this V/nD is for maximum speed and maximum r.p.m., and forms the basis for further calculations, it is called the design V/nD.

We can now figure the pitch angle at the tip of the propeller with reference to the forward speed of the plane. The translational velocity of the plane relative to the surrounding air *(airspeed)* is 120 m.p.h. or $120 \times 1.466 = 176$ feet per second. The circumference of the circle swept by the blade-tips is $6.8 \times 3.14 = 21.35$ feet. The number of revolutions per second is $2{,}000/60 = 33.3$.

The tangent of the pitch angle equals the translational velocity in feet per second divided by the rotational velocity in feet per second; tan. $a = 176/(21.35 \times 33.3) = 0.247$. From a table of natural trigonometrical functions we get $a = 13.9°$, or say 14°.

Now the question is: *What kind of pitch does this angle apply to?* In terms of plane speed, this pitch is correct, yet if the propeller were laid out in accordance with the pitch angles for different blade elements figured in the above manner, we should get a propeller that would be deficient in thrust, since the effect of the slipstream has not been taken into account at all. It is true that our propeller advances at the rate of 176 feet per second with reference to the surrounding air.

The propeller, however, works in a mass of accelerated air, the acceleration commencing some distance in advance of the propeller, and this mass of air has a velocity of its own in a backward direction with reference to the undisturbed outer air. *The propeller, therefore, must be designed for the total slipstream velocity in front of the propeller with reference to the plane.* The pitch angles thus obtained are the *effective pitch angles, and those are the only pitch angles that determine the performance and efficiency of the propeller.*

In order to compute the effective pitch angles, the effective disc area of the propeller should be calculated first. Authorities differ on this subject; the empirical Air-Service formula presented in our previous article is convenient and sufficiently confirmed by practice to be acceptable.

Effective disc-area $= A = 3.14/4 \times [D^2$

— (D/5)²], in which A is the area in square feet, and D the propeller diameter in feet. For our propeller A = 3.14/4 × [46.24 — 1.85] = 34.8 sq. ft. The approximate velocity of the slipstream can be found from the simplified formula:

$T = W/g \times AV_1v$

in which T = the thrust of the propeller in lbs., W/g = the weight of one cubic foot of air divided by the acceleration due to gravity, A = effective disc-area of the propeller, V_1 = airspeed of the plane, and v = the component velocity of the slipstream, both velocities being expressed in feet per second.

The thrust T, of course, is equal to the total drag of the plane, that is, the sum of the parasite drag and the wing drag, at the airspeed V_1.

Expressing T in lbs. and V_1 in miles per hour, we have thrust-horsepower = $T \times V_1/375$. The thrust T then is 375 × brake horsepower × efficiency of the propeller divided by the speed of the plane in miles per hour. In our case T = 375 × 200 × 0.8/120 = 500 lbs.

The component velocity of the slipstream $v = T/(W/g \times AV_1)$ or v = 500/(.00237 × 34.8 × 176) = 34.5 feet per second. It should be noted that the value of W/g is .00237 slugs, the slug being a unit of mass.

It was found, by experiment, that about 2/3 of the component velocity of the slipstream is induced in front of the propeller, the effective velocity of the slipstream relative to the propeller then is $V_1 + 2/3$ v, which in our case works out to 176 + (2/3 × 34.5) = 176 + 23 = 199 feet per second.

Some authorities advocate the addition of only ½ of the slipstream velocity; it is held however that the addition of 2/3 v puts the designer on the safe side and makes up in a measure for other detractions from the efficiency due to body interference or other causes.

Having found the slipstream velocity in which the propeller works, we find the tangent of the *effective pitch angle* at the tip of the propeller as follows:

Tan. a = 199/(21.35 × 33.3) = 0.280

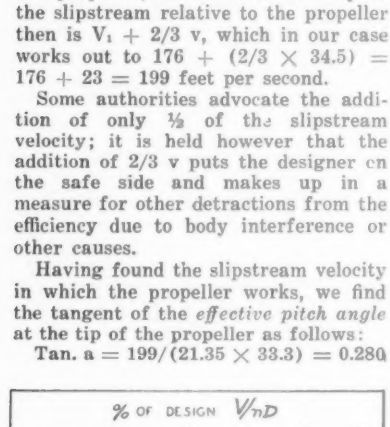


Fig. 3. Percent of maximum efficiency plotted against design V/nD.

This gives a pitch angle of 15.6° or 15° 36′, this being rather more than one and a half degrees over the so-called pitch angle initially figured.

It would be advisable to investigate the *tip speed* of the propeller under discussion, that is the rotational speed of the extremities of the propeller blades *with reference to the air in which they rotate.* The tip speed is not simply the rotational speed of the propeller tips as viewed from in front of the propeller, but means the absolute speed of the tips along the *effective helix described in the slipstream.*

This speed is graphically represented by the hypothenuse of the right triangle shown in Fig. 4, one side of which is the translational velocity of the plane relative to the slipstream, while the other side is the rotational velocity of the tip.

The tip speed of a propeller is of vital importance to its efficiency. Should the tip speed be excessive, the efficiency will decrease, and in some cases it may be necessary to decrease the diameter in order to keep the tip speed below its critical value. The tip speed should not exceed the velocity of sound in the air, which is about 1,050 feet per second, and which varies as the square root of the absolute temperature. These variations therefore are very small.

A safe limit for the tip speed is 950 feet per second. As soon as the tip speed approaches or exceeds the critical speed of 1,050 ft. per second part of the force normally used to drive the air backward is wasted in the process of compressing the air with a resultant loss in efficiency and an increase in noise and vibration. Calling the tip speed Vc, we have:

Sin. a = (V + 2/3 v)/Vc, or

Vc = (V + 2/3 v)/Sin. a

Since Sin. a = Sin. 15.6° = 0.2689, and V + 2/3v = 199, Vc = 199/0.2689 = 740 feet per second.

If we had taken the tip speed merely as the rotational speed in a vertical plane, we would have 21.35 × 33.3 = 711 ft./sec. Which is about 4% less than the actual tip speed. It is obvious that this difference becomes the more pronounced, the greater the ratio is of the absolute slipstream velocity to the rotational velocity; this feature should be carefully considered before starting on the actual design of the propeller.

It is not strictly necessary to calculate the pitch angle and the efficiency of each blade element separately; in most cases, especially in a preliminary lay-out, it is sufficient to calculate these values for an average section situated at a certain point of the radius out on the blade.

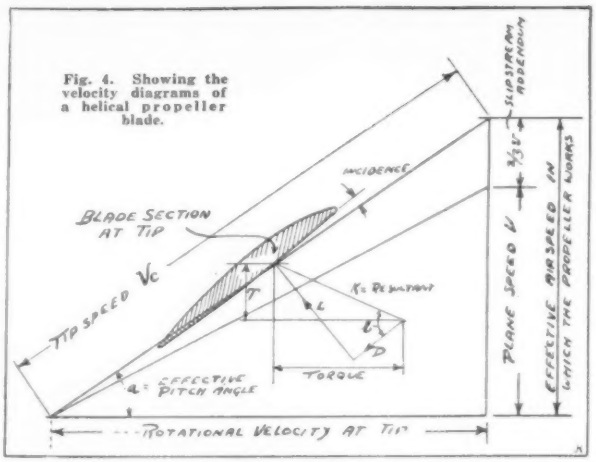


Fig. 4. Showing the velocity diagrams of a helical propeller blade.

Authorities differ on the exact fraction of the radius at which the blade's sectional profile can be considered as an average one for the entire blade. For the purpose of exemplification we shall make this radius 0.75 R, where R is the tip radius of the blade. This then brings our blade-element 0.75 × 6.8/2 = 2.5 feet out from the center of the propeller.

Neglecting the slipstream effect, this would give us:

Tan. a_1 = 176/16.01 × 33.3 = .33

and

a_1 = pitch angle = 18.3°

= 18° 18′

By taking into consideration the slipstream velocity we get:

Tan. a_1 = 199/16.01 × 33.3 = .377

a_1 = 20.7° = 20° 42′ = effective pitch angle

The efficiency of this blade element then represents the efficiency of the entire propeller, and is expressed as:

$$e = \frac{\tan.\ (b\text{-}a_1)}{\tan.\ a_1\ \left(\frac{V}{V + 2/3\ v}\right)}$$

It is important to find the value of b, since tan. b = L/D or the aerodynamic efficiency of the blade element. Now V/(V + 2/3 v) = 176/199 = 0.885.

Since we have based all our calculations on an assumed efficiency of 80%, e = 0.80, and our formula becomes:

0.80 = tan. (b-a_1) × 0.377 × 0.885, or

tan. (b-a_1) = 0.80/(0.377 × 0.885)

= 2.40

This makes (b-a_1) = 67.6°, and since a_1 = 20.7°, b = 67.6 + 20.7 = 88.3°. The tangent of this angle is 33.69, which represents the L/D of the profile section at 3/4 R.

The designer will now have to search the data on standard propeller sections, such as the R-A-F-6 or Clark-Y Series, for a profile having an L/D of over 33 at an angle of incidence of, say, 2°.

This L/D is extremely high and very likely he will fail to find an airfoil sec-

(Concluded on page 184)

High-Lights and Side-Lights

by M. A. RODDY

Pertinent and timely remarks upon aviation personages and doings in the aviation industry. The clearing house of aviation news in brief.

AMERICAN AIR RACES: As a curtain-raiser for Miami's seventh annual air show, Art Chester flashed about a 100-kilometer closed course for an average of 237.033 miles an hour, an unofficial world's record for planes weighing less than 992 lbs.

Raymond Delmotte, French speed pilot, who recently lowered the world's record for landplanes when he attained an average speed of 312.22 miles an hour, breaking the world's mark set by the late Jimmy Wedell, also held the previous mark of 214.92 in the restricted class . . . Military units opened the first day's program with their usual crowd-pleasing program featuring Maxwell Field's "Three Men on the Flying Trapeze," giving a remarkable exhibition of stunt flying . . . Clem Sohm thrilled with a delayed parachute jump.

According to Richard Hunter of Greensboro, N. C., sixteen of the parachute jumpers went on a strike when officials were paying about 50 percent more money for dropping a bag of flour than they were to the jumpers . . . Remaining jumps on the program were cancelled . . . Many social events marked the reception for Miami's noted guests and pilots.

* * *

LISTENING POST: It won't be long now before the "permanent" policy for air-mail legislation will become public and the new deal for the air industry will be in effect . . . It appears practically certain that the Commission will scrap the present air-mail contracts despite the persistence of Postmaster General James A. Farley to maintain them . . . Although the Commission applauded Postmaster General Farley for reducing air-mail charges nearly 50 percent following the wholesale cancellations of last February, they questioned his wisdom.

There seems to be no doubt but that President Roosevelt will be forced to choose between Mr. Farley's policy and the recommendations of the Federal Aviation Commission which he appointed . . . Observers are of the firm opinion that President Roosevelt will back up the Commission.

* * *

SPEAKING of commissions, the commission boys are working overtime with each crew trying to get the inside track . . . The Federal Aviation Commission would like to have their organization made a permanent group ($10,000 a year plus expenses) and Secretary of Commerce, Roper, would like the creation of a superbody to have charge of all forms of transportation policies . . . Sort of an expanded Interstate Commerce Commission.

Why not have a commission for the commissions, so that the "also rans" could get located . . . After all they probably have just as many impractical plans as the active commissions . . . Then, too, one could always pass the buck and this is an avenue that most commissions like to keep open.

* * *

PAN-AMERICAN AIRWAYS companies waived opportunity for public hearings in the Post Office Department's investigation of foreign air-mail contracts . . . Northwest Airlines, Inc., has purchased the Hanford Tri-State Air Lines and Braniff Airways has taken over the air-mail contract operated by Long and Harman between Dallas and Brownsville, Texas.

The camera caught a formation of Boeing P-26A's engaged in tactical flying. They belong to the 34th Pursuit Squadron.

* * *

AIR LINE PILOTS will enjoy the announcement of Southern Air Lines, formerly Pacific Seaboard Air Lines, that the company will comply with the National Labor Board Scale regarding pay and hours . . . Ditto for Delta Air Lines . . . However, trouble seems to be brewing for Braniff and a petition for cancellation of his air-mail contract may be presented.

* * *

HOWARD C. STARK, famous instructor in blind flying, who is now supervising installation of fog-flying aids at Floyd Bennett Field, takes issue with the present Bureau of Air Commerce practice in issuing Scheduled Air Transport Ratings. Mr. Stark claims that when pilots are allowed to qualify by "under the hood" instrument flying without being required to demonstrate the practical application of this skill under bad weather conditions, they are left holding the bag.

Stark contends that the "90-degree method" used by the Bureau teaches pilots to throw away half of the information the beacon supplies by disregarding entirely the "fade-out" if the plane is moving away from the beacon . . . The recent crash of the Hillman airliner over the English Channel in which seven persons were killed, has been attributed by the Air Ministry to poor navigation.

* * *

POSTMASTER GENERAL FARLEY continues to announce that the Post Office Department has a surplus of $12,161,415 for 1934 and the reduction of the air-mail postage rate to a flat six cents per ounce has resulted in an increased volume of mail . . . Air-mail appropriation for 1935 is $12,000,000 . . . Mr. Farley also predicts both Pacific and Atlantic air-mail service within a year.

* * *

EARLY BIRD: E. M. (Matty) Laird, the pioneer who designed and built the first commercial airplanes following the war, is now building custom planes at Ashburne Field . . . At present Matty is designing an all-metal six-passenger cabin job to cost about $25,000.

* * *

SIR CHARLES KINGSFORD-SMITH, noted long-distance flyer, has sailed for Australia leaving behind him his record-breaking plane, "Lady Southern Cross" . . . Financial trouble.

* * *

CHANCE-VOUGHT COMPANY of Hartford, Conn., has been awarded a naval contract for 84 bombing planes involving $2,500,000.

* * *

GET ALONG LITTLE DOGIE, GET ALONG: Bill Garrity, World War aviator, and Pilot Pharis Sarff of Hibbing, Minn., have been engaged by the Federal government to conduct an aerial cattle roundup of cattle purchased by the government during the drought period which wandered away and are now scattered about in wild recesses far from the roads . . . Charts

giving the possible location of the animals will be given the airmen.

* * *

CLYDE PANGBORN tells us that his proposed non-stop flight around the world will be made in 114 hours.

* * *

AMERICAN AIRLINES are now operating a transcontinental air sleeper linking New York and California and according to Ernie Orsatti, center fielder for the victorious St. Louis Cardinals, it is a good idea . . . Ernie believes that the baseball team should travel by air as it would save them losing much rest in sleepers on trains.

* * *

THE United States manufactured 1,285 airplanes during the first nine months of 1934 of which 673 were for domestic civil use . . . A total increase of 220 aircraft over the corresponding period in 1933.

* * *

DECORATIONS: Emory B. Bronte of Glendale, Calif., has been officially presented with the Distinguished Flying Medal in recognition of his flight from California to Hawaii in July of 1927 . . . Bronte and Ernie Smith, T.W.A. pilot, were the first civilians to fly from California to Hawaii.

HANGAR FLYING: Captain Eddie Rickenbacker has been appointed general manager of Eastern Air Lines but will continue to serve as vice president of North American Aviation . . . Miss Helen Richey, holder of the refueling endurance record for women flyers of 9 days, 21 hours, 42 minutes, is the nation's only woman flyer employed on an airliner . . . She is a co-pilot for Central Airlines . . . Another lady of the air is Madelyn Quirici of Cicero who lays claim to the air mileage record for stewardesses, having traveled over 240,000 miles since her employment in 1930 by the United Air Lines.

Recently Pilot Richard Dobie, first pilot for the same company, became a million-miler, when he received his seventh service star, denoting 7,000 flying hours with the company . . . Wiley Post intends to fly from Los Angeles to New York through the stratosphere using the Winnie Mae and his own especially designed "stratosphere" oxygen suit.

Miss Cora Sterling of the Seattle, Wash., police department is the United States' only flying policewoman . . . Captain Harry Manning, a hero of several sea rescues, has added to his laurels when, rather than abandon his plane which began to fall apart over the residential districts of Mineola, stuck to the ship and brought it to a fine three-point landing from a 3,000-foot altitude.

WALLACE BEERY, flyer and motion picture actor, has purchased a new six-passenger plane. This is his fifth plane in seven years . . . Speaking of motion picture actors, what's this I hear about Pilot Eddie Bellande keeping the postman busy with letters to Dorothy Mackail of the films? . . . Being an air-mail pilot, Eddie is in a position to speed delivery . . . Ray Colton, the former weather pilot for the Chicago area, called up to say hello and tell us that he is now in the Traffic Department for the American Airlines . . . See you higher up, Ray.

* * *

NEWS ITEM: Walter Winchell, ace of the Broadway columnists, calls attention to the fact that one of the magazines published in the interests of the air industry contained a recent article that Mr. Whitehead was the first man to fly . . . You may be interested to know that the article in question appeared in the January edition of POPULAR AVIATION.

* * *

RANDOM NOTES: Saw George Vest and John Casey in a huddle . . . Captain Ben Lipsner, first superintendent of the air mail, is a frequent visitor at local airports and is quite active in the Aviation Post of the American Legion . . . Yes, the fire is still simmering a bit under Mr. Vidal.

END

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-45

Bearing Unit Loading. See BEARING LOAD.

Beat-note. A regular impulse or note set up by the interference between two radio systems of different frequency. Also known as HETERODYNING.

Beaufort Scale. A simple chart for estimating wind velocities by the effect of the wind on dust, leaves of trees, etc.

Bee-line. The shortest distance between two points.

Bell. Any hollow conical or hemispherical body.

Bell, Alexander Graham. An early aeronautical experimenter, inventor of the tetrahedral kite and founder of the Aerial Experiment Association, which finally produced flying airplanes at an early date.

Bell-crank. A double arm crank mounted with both arms mounted on a common hub.

Belly. (1) To bulge out or swell as in the case of slack fabric or the fabric of a balloon. (2) The bulged out portion of an object.

Belly-band. Lines or ropes connected to the belly of a fabric structure.

Belt. (1) A rope or flat band employed for transmitting power between pulleys, or a band sewed to the envelope of a balloon for making connections, attachments or for stiffening the fabric. (2) A long strip of surface or a defined area on the earth's surface.

Belt-tension. The load placed upon a belt. In a BELT-DRIVE, the initial tension is the tension in the strands when the system is at rest.

Bench (Test). A factory test or laboratory test made upon a machine.

Bend. To deform a bar or beam by causing it to "sag" or deflect into a curved position. It is also known as TRANSVERSE DEFLECTION. No change takes place in the total length for one side of the beam is in tension while the other is in compression.

Bending-moment. The couple or effective leverage system tending to bend a beam. It is given in terms of inch-pounds in which the load in pounds is multiplied by the effective lever length in inches.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-46

Benzene. See BENZOL. (Not BENZINE).

Benzol. A light volatile coal-tar distillate belonging to the aromatic series of hydrocarbons. Makes an excellent motor fuel, free from tendencies toward detonation and can be added to gasoline to suppress detonation.

Benzine. (Obsolete.) Formerly the name of a light volatile series of petroleum hydrocarbons, but is no longer employed.

Benzoline. A compound fuel or a mixture of benzol and gasoline, employed in automobile or aviation engines. Anti-detonative.

Be°. Abbreviation for BAUME' gravity degrees.

Bernoulli's Theorem. This law expresses the relation between pressure and velocity at any point in a stream for an inviscid incompressible fluid. If p = pressure and q = mass unit volume, then:

$$P - \tfrac{1}{2}qv^2 = \text{constant.}$$

In a continuous fluid stream, the velocity is inversely proportional to the pressure.

Bessemer Steel. Steel produced from cast iron by blowing heated air through the molten metal. This burns out the free carbon and leaves only the required percentage of combined carbon.

Beta. Second letter of the Greek alphabet.

Betriebsteile (German). Working moving parts.

Bevel. (1) To cut a sloping edge, or an angular edge. (2) See BEVEL-GEARS.

Bevel-gears. Toothed gears arranged to transmit motion with their shafts at an angle but in the same plane. The faces of these gears are conical.

Bi. (1) Chemical symbol for BISMUTH. (2) Prefix meaning half.

Bielle du Tiroir (French). Valve-stem.

Bifurcate. To form into a two-prong fork or to produce two legs.

Big-end. The large end of an engine connecting-rod that embraces the crankpin.

Biplace. Two-place or a two-seated aircraft.

Biplane. An airplane having two wings or lifting surfaces, a top wing and a bottom wing.

The National Glider Movement

by "SPEED" WESTPHAL

Glider fans will welcome the efforts of Mr. Westphal in restoring activity in gliding. Read what he says below and lend your efforts toward promoting this great sport.

WELL, my dear frans, we're off the good old mother earth, aided by a brisk wind that is really blowing in the mail from all points of the U.S.

So far, I've heard from 45 states which I guess isn't so bad in answer to the first two articles and incidentally, it sure proves something in the way of circulation for our old stand-by, POPULAR AVIATION. From all appearances, this magazine must be using the magic carpet for distribution.

Our big enemy, so I gather from the hundreds of letters which made a three-cent landing in this office, is Old Man Depression so we'll take care of him first before we go into the other business on hand. Many young men write me, saying they only make $15 per week and can't seem to save enough to join a club or purchase a few parts to construct a glider. I'll bet five dollars to a broken skid, they could save some if they would forget a few of their Saturday night dates.

Don't take this too much to heart but, from a standpoint of experience, I know that if your girl friend really goes for you like she should, she'll be glad to see you save the dough. If she doesen't like you that way, then you shouldn't worry anyway.

Take it from me, for every girl you lose now, you'll have four out at the airport getting their tonsils sun-burned when you make that first five-hundred-foot hop. At least you don't have to agree with a glider to keep it quiet and that's a great help.

Now, to get down to the business of where the glider clubs are, what they are doing and what they are not doing. First of all comes a letter from an alright guy, whose name is Harry Griffith. He has a club at 1907 Tremont Street, Selma, Alabama. He sends along some ver-veree nice pictures of himself and the Franklin glider, doing some no-hands, no-feet control stuff over the local bald-headed wheat field. Harry tells me he'll be glad to help any interested young man or woman in his locality and, from his experience, I'll put the O.K. on him any day.

Number Two is a guy what's got a job as acting secretary for the Baltimore Gliding Club (don't let the English fool you, I'm only doing it to get the printer up in the air. When that's done, I'll feel I've got the last man.) located at 4036 Fairfax Road, Baltimore, Md. They have a fine Mead Ranger and are planning the purchase of a secondary. You fellows in his locality, kick some rudder in his direction. He'll be glad to have you, and after reading his letter, I O.K.'s him, too. His name is Nathan Frank.

Another self-photograph taken in a Franklin Glider.

* * *

You glider bugs down around Louisville, Ky., better get in touch with Byron C. Baldwin, located at 2126 So. First St. He's a swell kid with swell ideas.

* * *

Grant L. Bates is the rudder kicker to contact at Murtaugh, Idaho.

* * *

Frank Storm is the organizer of a club at 1710 Harrison St., Amarillo, Texas. From reports, he's getting along great. They expect to do their flying at the English field airport. Drop him a line, boys.

* * *

A letter from Eugene Bumpas of 903 N. 9th St., Duncan, Okla., informs me he has the necessary interest but lacks the knowledge of organizing. I'll get to that as soon as I get all you birds straightened out.

* * *

Here's one from the canning center (If Henry Ford reads this, I'm only fooling.). The Skid Straddler that paid the postage from good old Detroit, Mich., is Andrew Shevchik of 5632 Homedale Ave. Andy has taken an aeronautical course at the Cass technical school and should be an alright fellow to team up with.

* * *

As for Chicago, Harry Peterson of 2342 N. Monticello Ave. is organizing a club on the north side and everything is already in full swing. I will help this club and also organize one on the south side. I started ten days ago and already have seven active members.

* * *

I have several offers on gliders for sale, ranging in price from $50 to $200. If you clubs that are all set will get in touch with me, I will contact you with the owners.

Now, for organizing. The first thing to do, if you are an interested individual, is to drop me a line giving your name, age, and experience. Second, write a small article, announcing your intentions of starting the club and have some printed in the local bla-bla. You'd be surprised how a little article will pull and work up interest. Third, call a meeting of all those answering the story and read this, as well as my article, "Where Are the Glider Clubs?"

Have them place any amount they can spare into a kitty. I'm sure you will secure enough cash to purchase the blueprints and the rib material from a recognized company. Do not worry about a workshop until you are ready to assemble the wings. All the ribs, fuselage, control surfaces, etc., can be constructed right in your basement, attic or back porch. All the necessary ribs and other small parts can easily be made without large tools and should be completed in not over two weeks' spare-time work.

At the end of this time the members of the club should have saved the money necessary to purchase the fuselage material. This should also be constructed in a week or ten days, and believe me, when some of the fellows around the neighborhood see those ribs and fuselage hanging about, you won't be able to keep them away with four baseball bats, seven Boy Scouts and a Campfire Girl.

* * *

I have received word from one of our leading glider companies that all clubs formed under this national glider movement will receive a 15 percent reduction in the price of material. Your letter addressed to me will be turned over to this company by request.

Before I close, I want to thank all you fellows for writing me and ask

(Concluded on page 199)

Building the Corben Super-Ace

by O. G. CORBEN

The second construction article telling how to build a fine little Ford powered lightplane which has given excellent performance in its flight tests.

NOW that I have finished making up my list of New Year's resolutions (most of which have already been broken), I will try to get back to work and reel off some more do's and don'ts for building your Corben Super-Ace.

Judging from all the letters we have been receiving of late, it sure looks like the Super-Ace has been working its way into the desires of the sportplane builder. Our mail man thinks the Christmas rush is still on, but it is only a flood of letters from the readers of POPULAR AVIATION who are starting or planning to build up a Corben Super-Ace.

All of these letters prove one thing to me, and that is, my efforts to design a reliable yet inexpensive sportplane have not been in vain and also proves that there are hundreds of young men who want to get into the air and fly. Well, get out the old yard-stick, saw and hammer and get busy on your Super-Ace for if this series of articles helps you to realize your ambition to fly it has fulfilled its purpose.

In the last issue, the plans for the wing-ribs were published, so this time we will go ahead building the wings. I will admit that the building of ribs is somewhat of a tiresome job, but nevertheless an important one. However, this month you can go on with the assembling the wings which is an easy job and you get an idea that you are really building an airplane.

When I say that assembling the wings is an easy job, I do not mean that time and care are not to be taken on this work, for it is essential that you take every care and follow all details of the drawings, or else you will get into a lot of trouble and end up with a wing which won't be worth covering. You will find assembling the wing is very simple; if you just follow the details carefully the wing will go together very nicely.

It is very important that only grade "A" aircraft spruce be used for the spars and aircraft waterproof plywood be used wherever it calls for plywood. While these little plywood details do not appear to be very much, they really play quite an important part in the strength of the wing structure, so do not slight them in any way.

The wing fittings and their assembly are also shown in this issue and you will note the material called for in all fittings is 1025 steel. This may and again it may not mean anything to you, so a word on the subject. 1025 is the S.A.E. number of the steel and is a key to the quality of the material, the strength of this steel is known and the fittings designed accordingly. Therefore, if you do not use this material your fittings will not be strong enough and no doubt fail under loaded conditions. While steels may look alike to you, be sure that you are getting 1025 steel, it may be just a little higher in price, but it is well worth the small difference.

The trim little Ford-motored Corben Super-Ace looks like a pursuit job and is not far from performing like one. And, best of all, it has real flying ability as well as good looks.

On the fitting drawing you will note that where holes are shown in the fittings it will say "Drill ¼," or such as the case may be. If you have access to a small punch outfit, it would be much better to punch the holes instead of drilling them, for a much better fit can be obtained than by drilling. However, the latter will be all right but care must be taken so the drill does not "walk" off center.

When bending up the fittings do not make sharp bends, but allow a radius approximately the same as the thickness of the material you are bending. For instance, if you are bending a piece ⅛" thick, then a ⅛" radius should be allowed. Where the letter "R" is used on the drawings it means radius.

It will be well to make up all fittings before starting to put the wing together. After all of the fittings are made, either have them cadmium plated or paint them with a rustproof paint, such as red lead or a silver paint with an asphalt base.

With the fittings all painted and set aside you can start to work on the wing itself. First, lay out the spars as detailed by drawing a line the full length to represent the neutral axis; do not confuse this with the center line for they are not the same. This was explained in detail in the article on building the Corben Junior-Ace some time ago. Note the details on the end view of the spars and you will see the distance of the neutral axis from the bottom of the spars.

After the neutral axis is drawn on the spars, then lay out for all holes to be drilled as shown. Care should be taken here so the holes are drilled straight through the spars. You will notice that some of the holes drilled in the spars are larger than the ones drilled in the wing strut and root end fittings. This is done so a steel bushing may be inserted in the hole in the spar through which the fitting bolt is placed.

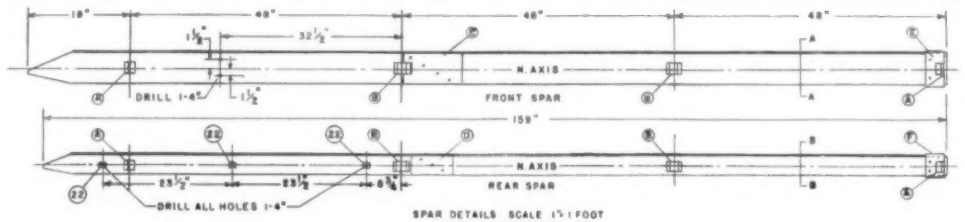
It is necessary that the bushings be used or the bolt would have a tendency to pull into the spar. The bushings are cut a little less than the thickness of the spar in order to let the fitting be bolted tight against the spar.

When all holes are drilled, the next step is to slide all the ribs in place as shown. Do not nail them as yet. Now nail and glue the plywood reinforcements in place. Nail them to one side first, then run a drill through the spar and drill the plywood to match the holes in the spars. The other side is then put on and the drill run through from the other side so the holes in the plywood will be the same as those in the spars.

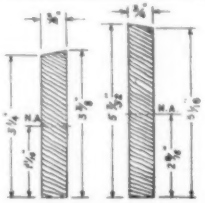
The tie-rod end blocks come next. They are glued and screwed to the spars. These blocks should be made up and drilled before attaching. When all of the blocks are in place, drill through the hole in the block into the spar so the tie-rods will pass through the spar. See that the holes are drilled straight so the tie-rod does not bind in the spar.

Next comes the alignment of all the ribs. Be sure to space them accurately

(Concluded on page 199)

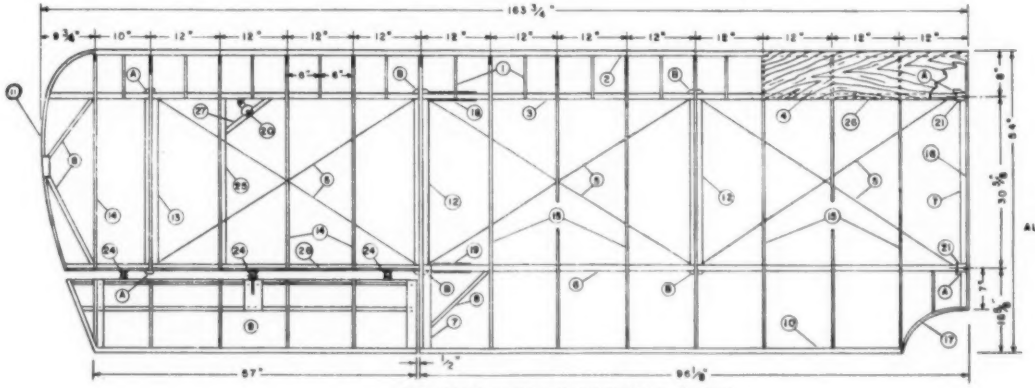


SPAR DETAILS SCALE 1"=1 FOOT
MATERIAL GRADE-A SPRUCE
1-RIGHT & 1-LEFT REQD.

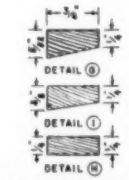


SECTION B-B REAR SPAR SECTION A-A FRONT SPAR
SCALE HALF SIZE

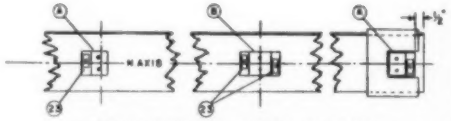
NO.	DESCRIPTION	DRW. NO.
1	ALUMINUM FALSE RIBS	A-3
2	LEADING EDGE	A-3
3	FRONT SPAR	A-2
4	1-32" PLYWOOD TOP & BOTTOM	A-2
5	6-40 HEADED TIE RODS	A-2
6	REAR SPAR	A-2
7	1-4X1" SPRUCE TOP & BOTTOM	A-2
8	5-8" SQ. SPRUCE BRACES	A-2
9	AILERON	A-5
10	TRAILING EDGE	A-5
11	WING TIP	A-5
12	COMPRESSION RIBS	A-3
13	COMPRESSION RIB	A-3
14	AILERON RIBS	A-3
15	FULL LENGTH RIBS	A-3
16	ROOT END COMPRESSION RIB	A-3
17	TUBING CUT AWAY	A-8
18	FRONT WING STRUT FITTING	A-4
19	REAR WING STRUT FITTING	A-4
20	AILERON PULLEY & FITTING	A-4
21	ROOT END FITTINGS	A-4
22	AILERON HINGE BLOCKS	A-8
23	TIE ROD END WASHERS	A-4
24	AILERON HINGES	A-4
25	REINFORCED AILERON RIB	A-3
26	1-4" SPRUCE FILLER STRIPS TOP & BOT.	A-2
27	INSPECTION OPENING	A-3



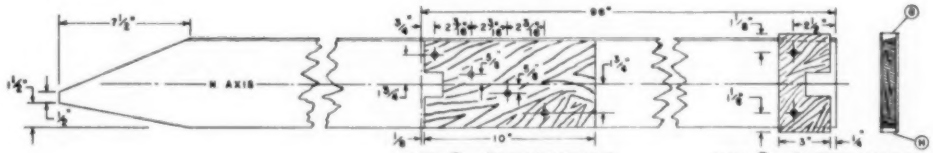
WING ASSEMBLY LEFT WING SHOWN. SCALE 1"=1 FOOT
SEE DRAWING NO. A-8 FOR GAS TANK DETAIL

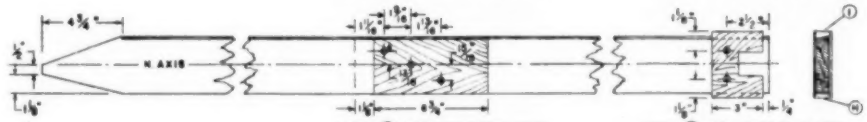


ROOT END FILLERS-FULL SIZE
ALL BLOCKS 5" LONG. END VIEW SHOWN
MATERIAL SPRUCE

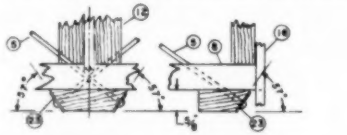


SECTION OF SPAR SHOWING TIE ROD END BLOCKS
GLUE & SCREW BLOCKS TO SPARS USE 1 1-4" NO.6 F.H. SCREWS



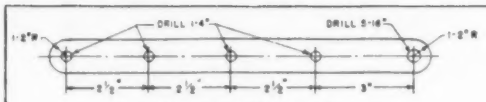


SPAR GUSSETS & WING TIP DETAILS SCALE 3"=1 FOOT
NAIL & GLUE GUSSETS TO SPARS AS DETAILED ALL
PLYWOOD AIRCRAFT SPEC. NOTCH FOR TIE ROD BLOCKS
DRILL ALL HOLES 3-8" AS DETAILED

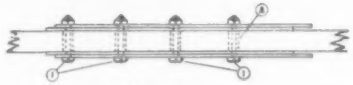


TIE ROD END BLOCKS SCALE-HALF SIZE
MATERIAL HARD MAPLE

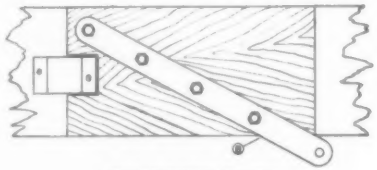
THREE VIEW ASSEMBLY	
"CORBEN SUPER ACE"	
SCALE-NOTED	DATE-12-18-34.
DRAW. BY-O.G. CORBEN	TRACED BY-O.G.C.
CORBEN SPORT PLANE CO. MADISON WISCONSIN	A-2



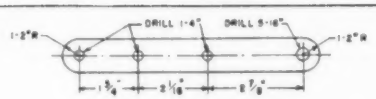
DETAIL "B" FRONT WING STRUT FITTING
HALF SIZE - MATERIAL .125-1025 STEEL
4 - REQUIRED



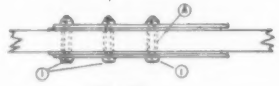
TOP VIEW



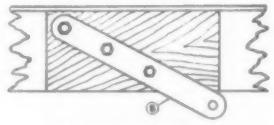
FRONT WING STRUT ASSEMBLY
SCALE 3-8"=1"



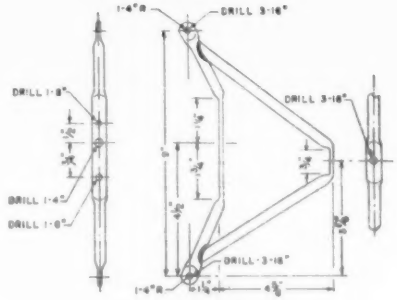
DETAIL "S" REAR WING STRUT FITTING
HALF SIZE - MATERIAL .125-1025 STEEL
4 - REQUIRED



TOP VIEW



REAR WING STRUT ASSEMBLY
SCALE 3-8"=1"



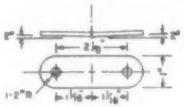
AILERON HORN ASSEMBLY DETAILS
SCALE HALF SIZE
MATERIAL .035-1025 TUBING. 2-REQUIRED

LIST OF BOLTS, CLEVIS PINS & WASHERS

1	1-4"X1 5-8" A-N BOLTS
2	1-4"X1 1-2" A-N BOLTS
3	1-4"X 6 3-4" A-N BOLTS
4	1-4"X 5" A-N BOLTS
5	1-4"X1 1-4" A-N BOLTS
6	1-4"X1 1-4" A-N BOLTS
7	10-32"X1-2" A-N BOLTS
8	1-4"A-N 907-4 WASHERS
9	1-4"X 1"A-N CLEVIS PINS
10	5-16"X17-32" CLEVIS PINS

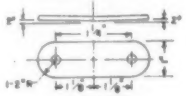
NOTE
ALL BOLTS ARE NICKLE STEEL A-N SPECIFICATIONS. CASTEL NUTS ARE USED ON ALL BOLTS

WING FITTING BUSHING DETAIL "A"
FULL SIZE
MATERIAL 3-8"X .065-1025 TUBING
22-REQUIRED



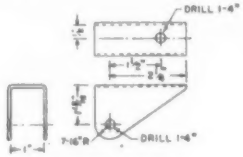
DETAIL "G"
1-REQUIRED

DETAIL "E"
2-REQUIRED

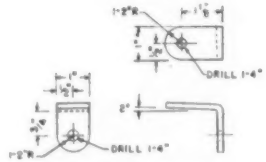


DETAIL "H"
1-REQUIRED

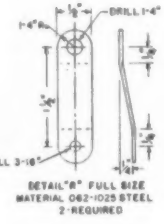
WING TIE PLATES
SCALE HALF SIZE
MATERIAL .125-1025 STEEL
DRILL ALL HOLES 1-4"



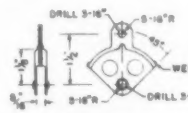
ROOT END FITTING DETAIL "D"
SCALE HALF SIZE
MATERIAL .062-1025 STEEL 8-REQD



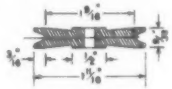
DETAIL "B" CABANE WING FITTING
SCALE HALF SIZE
MATERIAL .125-1025 STEEL
4-REQUIRED



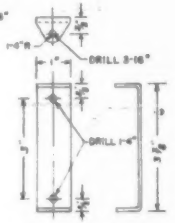
DETAIL "R" FULL SIZE
MATERIAL .062-1025 STEEL
2-REQUIRED



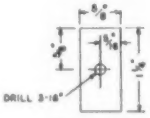
DETAIL "R" PULLEY HOUSING
SCALE HALF SIZE
MATERIAL .035-1025 STL. 6-REQD.



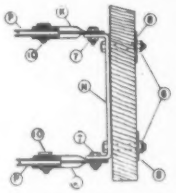
ALUMINUM CONTROL PULLEY
DETAIL "P" FULL SIZE
7-REQUIRED



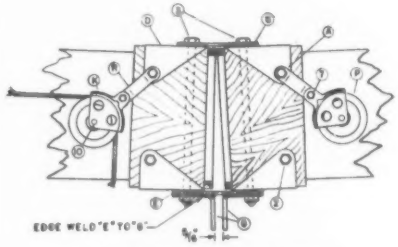
DETAIL "N" SCALE HALF SIZE
MATERIAL .125-1025 STEEL
2 REQUIRED



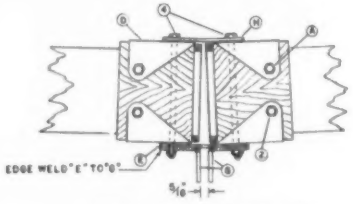
TIE ROD END WASHER
FULL SIZE
MATERIAL .062-1025 STL.
24-REQUIRED



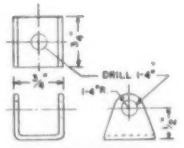
AILERON PULLEY ASSEMBLY
SCALE 3-8"=1"



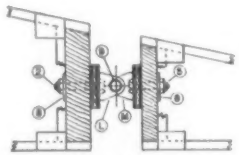
FRONT ROOT END WING FITTING ASSEMBLY
SCALE 3-8"=1"



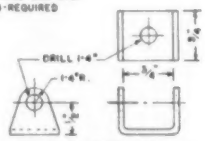
REAR ROOT END WING FITTING ASSEMBLY
SCALE 3-8"=1"



DETAIL "M" AILERON HINGE
FULL SIZE. MATERIAL .125-1025 STL. 6 REQUIRED



AILERON HINGE ASSEMBLY
SCALE 1-8"=1"



DETAIL "L" AILERON HINGE
FULL SIZE MATERIAL .125-1025 STL. 6-REQUIRED

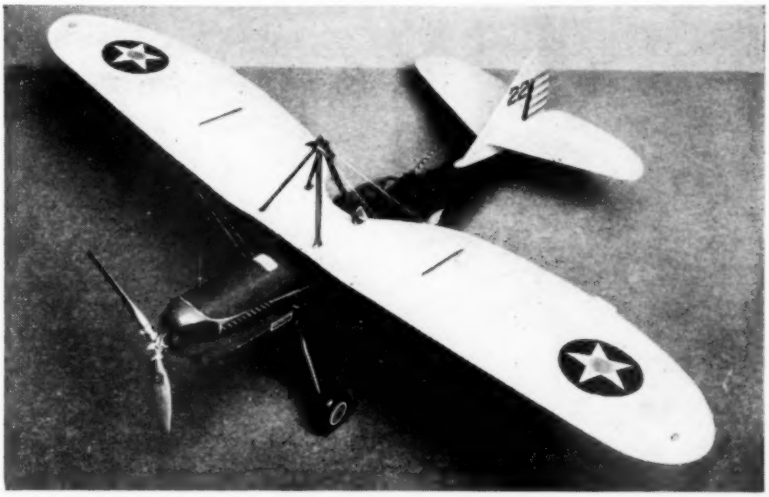
WING FITTINGS AND DETAILS	
"CORBEN SUPER ACE"	
SCALE NOTED	DATE 12-20-34
DRAW BY-O.G CORBEN	TRACED BY-O.G.C
CORBEN SPORT PLANE CO. MADISON WISCONSIN.	A-3

Building the Douglas O-43A

This design is copyrighted and is released only for the use of our readers. This design or any part of the construction may not be used for commercial purposes without the consent of the author.

by
PAUL W. LINDBERG

Model editor and model designer for POPULAR AVIATION.



This model, built in our laboratory, is a beautiful and realistic bit of work. It flies well and is worthy of your best efforts.

BUILDING and flying the model of the Douglas will thrill you from start to finish. Study the plan carefully and note the many new and improved features. All details have been very carefully worked out, and when the model is completed, it represents an exhibition model as well as a flying model.

The ailerons, elevator and rudder have been improved to such an extent that they operate in very much the same manner as those of the larger ships. This is another exclusive feature developed by our laboratory. All dimensions can be quickly and accurately determined by placing a ruler on the parts to be measured. If you wish a larger model, multiply this measurement by the amount of increase.

COLOR SCHEME

Wing and tail surfaces, yellow; fuselage, struts, etc., olive drab; trimmings, red with white pin stripe; other small details, black. See cover of this issue.

CONSTRUCTION OF FUSELAGE

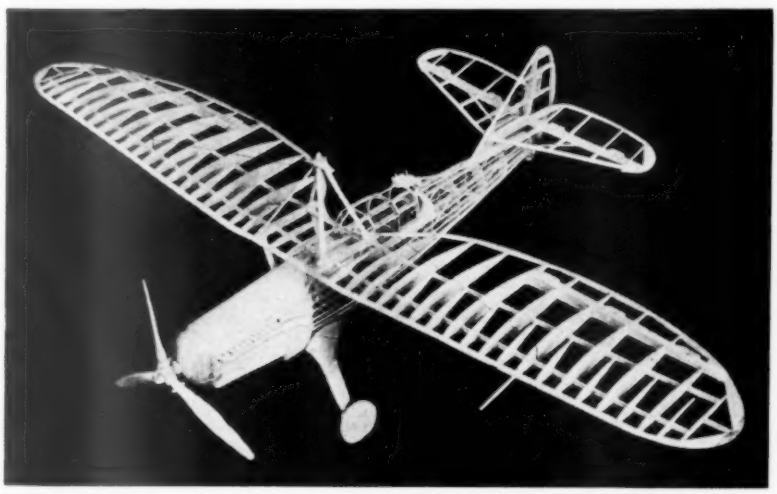
First, place waxed paper on top of plan to prevent parts from sticking to plan. The fuselage sides are built from 1/16-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips wherever needed.

When the sides are completed, the cross-members are cemented into their proper locations. Check carefully front to rear for alignment. Cut the formers from 1/32-inch sheet balsa and cement in their respective positions as shown on the plan.

The positions of all stringers are clearly shown on the formers. Stiff paper is used in covering top of fuselage from nose to F-4 to F-5 and completely around front of fuselage from nose to former F-9. Do not try to cover in one piece.

CONSTRUCTION OF WINGS

Cut all ribs from 1/32-inch balsa. Pin the spars to position on the plan. Next, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape, then cemented to the ribs. Great care should be taken in constructing the ailerons, spars and parts. Carefully shape the spars as shown on plan. The aluminum hinges should be cemented securely to the ailerons before covering. Apply a small amount of cement to other end of hinges, and insert aileron in position after wing and aileron have been completely covered and painted. Make slots, to receive hinges, with a broken razor blade or a sharp knife.



Here we have the uncovered framework of the Douglas 0-43A, showing the wing and fuselage construction.

CONSTRUCTION OF ELEVATOR AND RUDDER

The elevator and rudder are streamline, and they require much care in the construction. Cut all ribs from 1/32-inch balsa. Build parts upon plan. Fillets for elevator and rudder are made from soft balsa.

CONSTRUCTION OF FILLETS

Cement small pieces of wood to the ends of the wing struts, etc. Carefully sand to shape and reinforce with a small piece of wire. See plan.

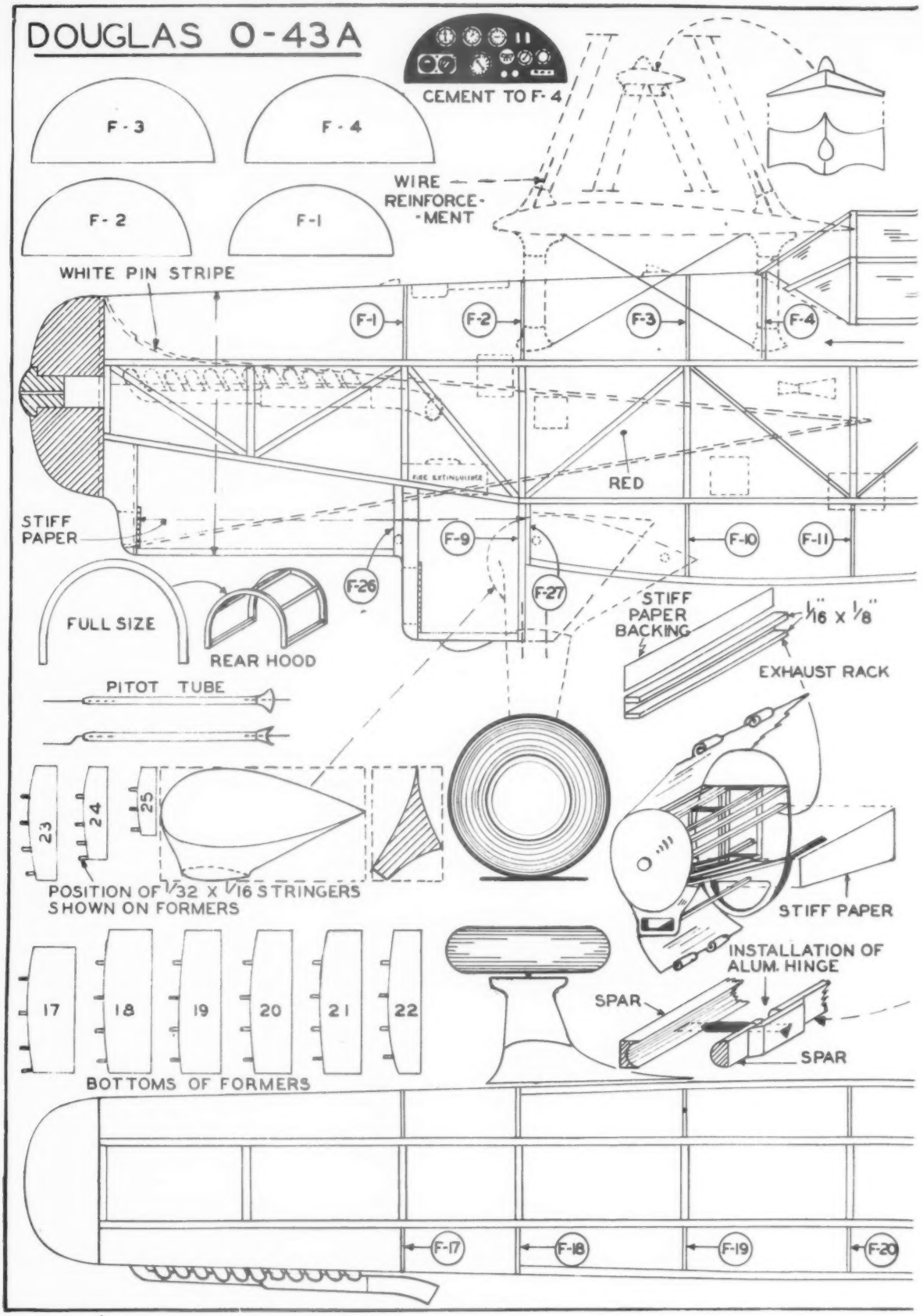
CONSTRUCTION OF EXHAUST PIPES

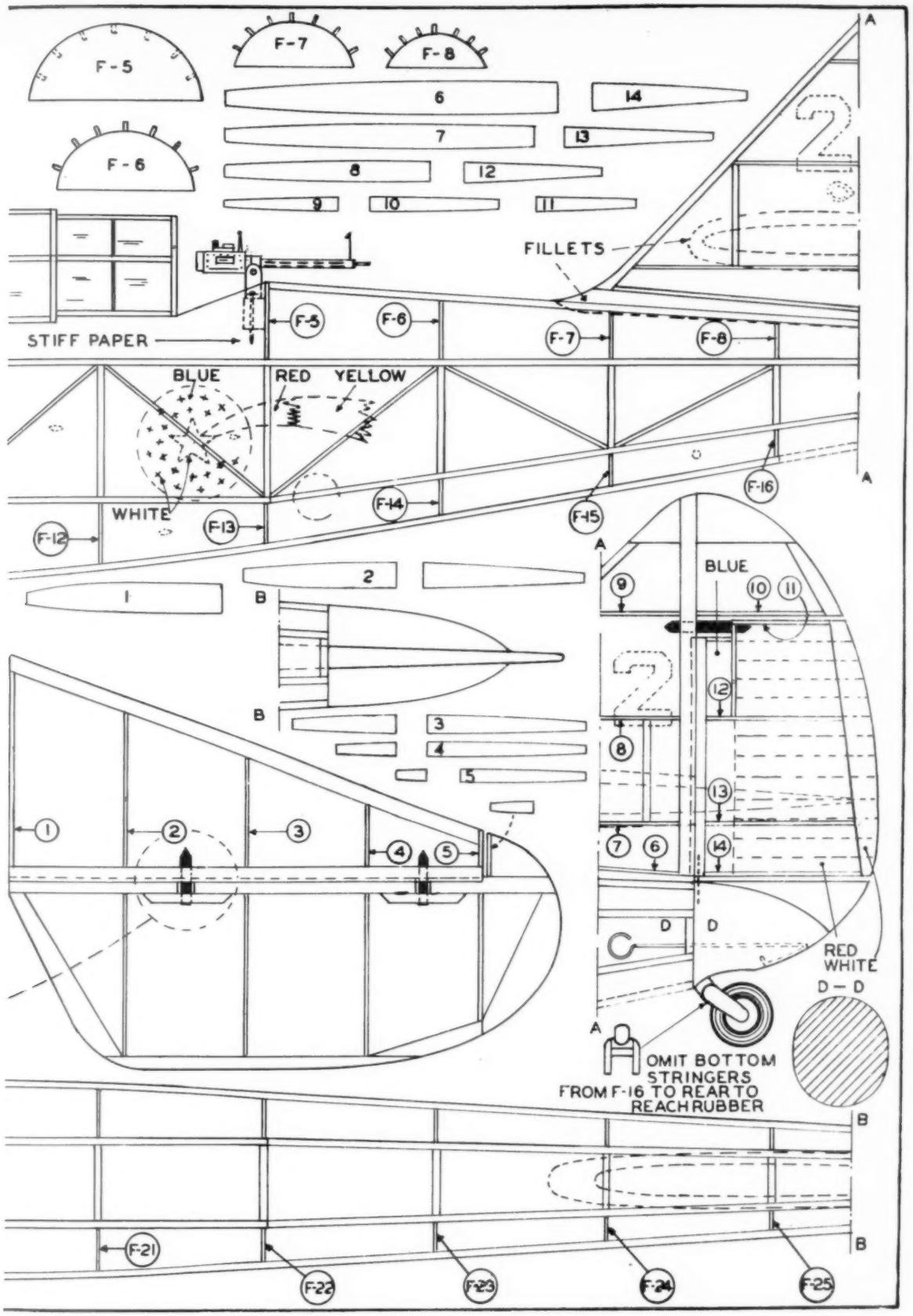
Select a soft grade of balsa and carefully carve and sand the exhaust pipe, which is built in three sections. The stacks are cemented on separately.

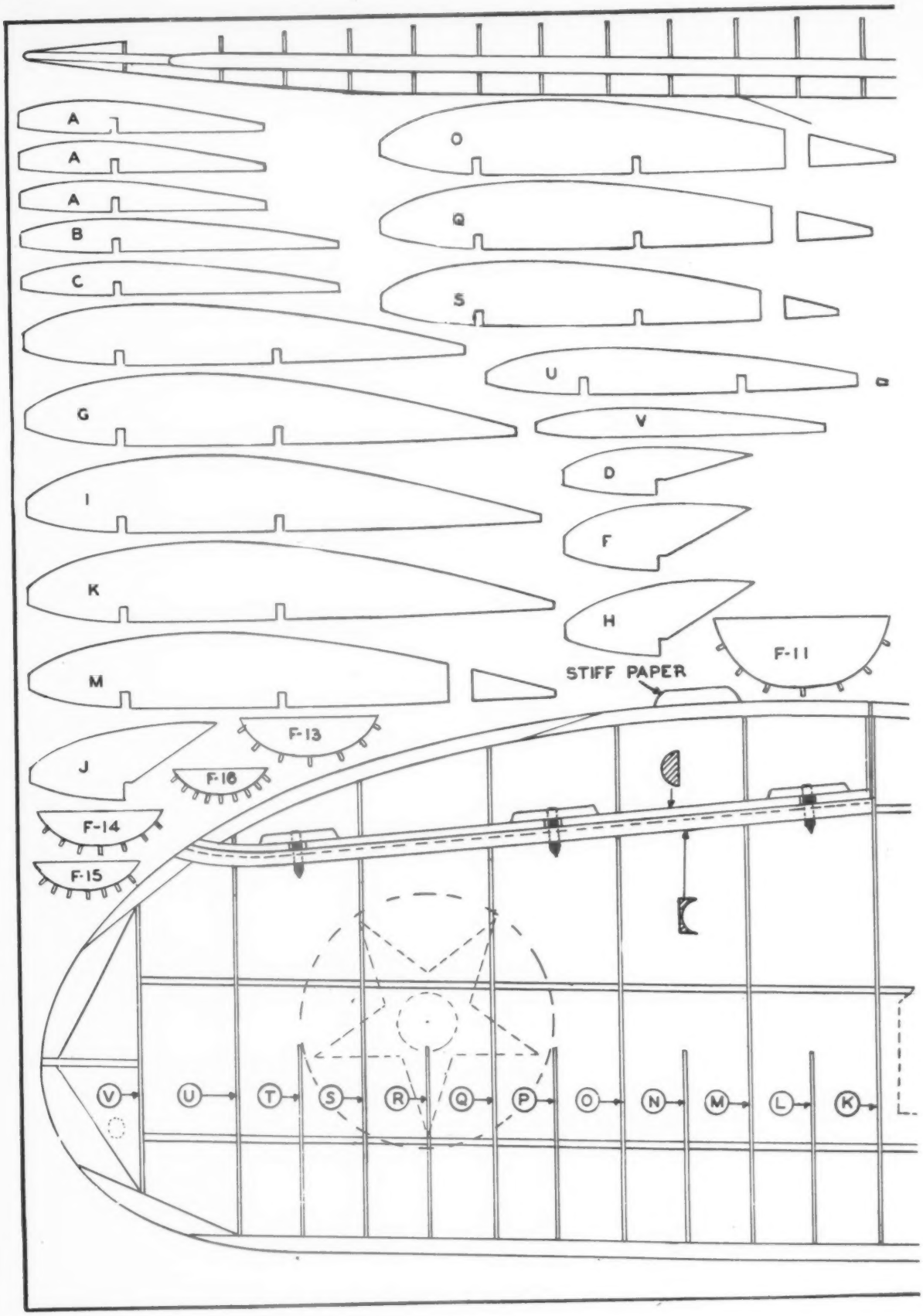
CONSTRUCTION OF LANDING-GEAR

The upper part of landing-gear strut is carved to form a fillet. Next, shape the lower parts of landing-gear struts, making sure that these are reinforced with short lengths of piano wire. Shock absorber is clearly shown on plan. Study details thoroughly.

(Concluded on page 198)


DOUGLAS O-43A
CEMENT TO F-4
F-3
F-4
F-2
F-1
WIRE REINFORCE-MENT
WHITE PIN STRIPE
F-1
F-2
F-3
F-4
RED
STIFF PAPER
F-9
F-10
F-11
F-26
F-27
FULL SIZE
REAR HOOD
STIFF PAPER BACKING
1/16 x 1/8"
EXHAUST RACK
PITOT TUBE
23
24
25
POSITION OF 1/32 X 1/16 STRINGERS SHOWN ON FORMERS
STIFF PAPER
INSTALLATION OF ALUM. HINGE
SPAR
SPAR
17
18
19
20
21
22
BOTTOMS OF FORMERS
F-17
F-18
F-19
F-20


F-5
F-7
F-8
F-6
6
14
7
13
8
12
9
10
11
FILLETS
STIFF PAPER
F-5
F-6
F-7
F-8
BLUE
RED
YELLOW
WHITE
F-12
F-13
F-14
F-15
F-16
A
A
1
2
B
B
3
4
5
BLUE
9
10
11
12
8
13
7
6
14
D
D
RED
WHITE
D – D
OMIT BOTTOM STRINGERS FROM F-16 TO REAR TO REACH RUBBER
F-21
F-22
F-23
F-24
F-25


A
A
A
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C
O
Q
S
U
V
D
F
H
F-11
STIFF PAPER
G
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K
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J
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F-16
F-14
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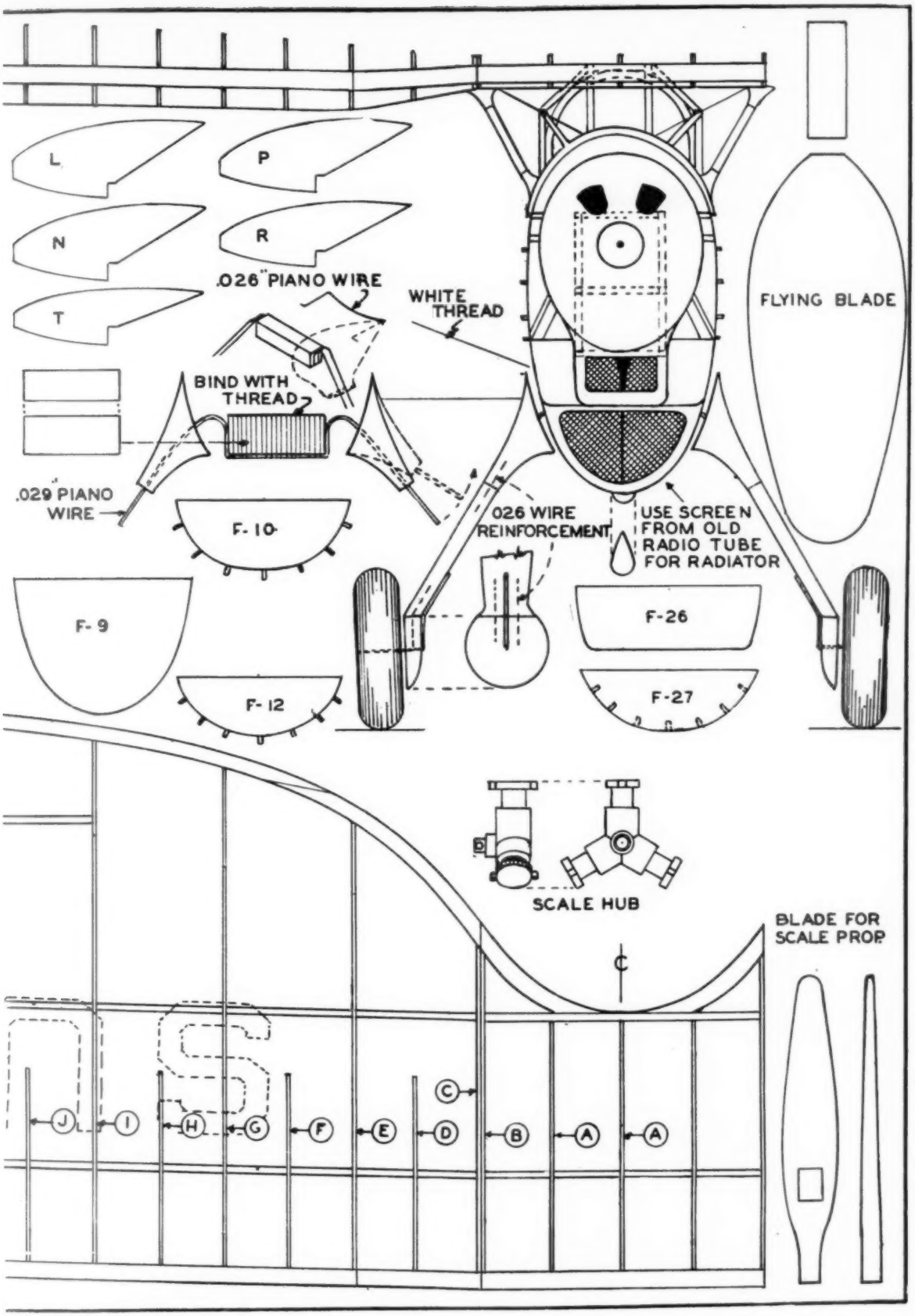
L
P
N
R
T
.026" PIANO WIRE
WHITE THREAD
BIND WITH THREAD
.029" PIANO WIRE
F-10
F-9
F-12
026 WIRE REINFORCEMENT
USE SCREEN FROM OLD RADIO TUBE FOR RADIATOR
F-26
F-27
FLYING BLADE
SCALE HUB
BLADE FOR SCALE PROP
J
I
H
G
F
E
D
C
B
A
A

The Russian Giant Monoplane "Maxim Gorki"

A new and intimate view of the Russian giant, "Maxim Gorki."

THIS is a view of the tremendous Soviet monoplane, the Maxim Gorki, which gives a good impression of its size. It is said to be the largest landplane at the present time.

The Maxim Gorki has a wing-span of 210 feet and can carry a useful load of from seven to eight tons at a speed of 133 m.p.h. As a passenger plane, it can carry 70 passengers and a crew of six men. It is employed as a means of disseminating propaganda by distributing pamphlets and circulars over the wide expanses of Russia. A full description of this plane was given in a past issue of P.A.

The equipment is unusually complete for the purpose served by the ship. It carries a complete printing plant so that circulars can be printed en route according to the local conditions or territory over which the plane may be flying. A powerful radio transmitter is also installed which has a range of several thousand miles. The symbol of the type is ANT-20.

Both the ship and the engines are Russian products and it is therefore essentially a Russian type. It was under construction for many months and the greatest secrecy prevails regarding the interior construction of the tremendous cantilever wings. Whether this type has any military significance it is difficult to say, because of its reputed slow speed, but as a commercial transport type it is decidedly interesting.

It is said that the six wing-engines were only contemplated in the design and, when actual tests were made, it was found necessary to add the two engines shown standing above the center-section over the fuselage. Not much attempt has been made at streamlining the fuselage which is strikingly rectangular and abrupt in form. Further, the back-swept leading edge of the wings, while providing stability to a certain degree, retard the ship.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-47

Biplane-cell. (1) A complete biplane wing unit consisting of two wings and the necessary structural parts for their construction. (2) The biplane surfaces in proper relation but without the inclusion of the structural members.

Biplane-Coefficient. The relative lifting value of a BIPLANE group referred to the lifting value of a monoplane of equal area and under equal conditions.

Biplane Distribution. The relative distribution of the loads carried by the upper and lower wings of a biplane. Under normal flying conditions, the upper wing carries the greater part of the load.

Biplane-gap. The vertical distance measured between the top and bottom wings of a biplane.

Biplane-interference. The loss of lift in the wings of a biplane due to reactions taking place between the two wings. The lower wing, for example, loses lift because of the air-stream forced down on it by the upper wing.

Biplane-overhang. The amount by which the long wing of a biplane pair overhangs or projects beyond the shorter wing.

Biplane Stagger. The distance by which one wing of a biplane is set ahead or behind the other wing. The horizontal advance of one wing over the other. The stagger is said to be positive when the leading edge of the top wing is farther forward than the leading edge of the lower wing. Negative stagger shows the lower wing advanced.

Biplane (Staggered). A biplane in which the leading edge of one wing is set ahead of the other wing.

Bipolar. (1) A magnet with both poles placed close together. (2) A generator or electric motor having two field poles. (3) A lifting surface having two planes of flexibility.

Bis. (Fr.). The second of a series.

Bismuth. A metal often used for ALLOYING with brasses and bronzes.

Bisc. A cold north or northeast wind in the Rhone valley.

Bitumen. A black substance found in ASPHALT.

Bituminous-paint. A water-proof asphaltic paint.

Black-ray. An invisible light-ray such as ultra-violet light or infra-red rays which have frequencies above and below the range of the human eye.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-48

Blade. A revolving vane or active surface of an AIR-PROPELLER.

Blade (Adjustable). A propeller blade of the helical type so constructed that the BLADE-ANGLE or ANGLE OF PITCH can be varied.

Blade-angle. The acute angle between the chord of a propeller BLADE-SECTION and the plane of rotation (at right angles to the shaft).

Blade-angle of Pitch. The angle made by the chord of a propeller blade-section with the plane of rotation, taken at a point along the blade that represents the GEOMETRICAL PITCH of the propeller. Generally at two-thirds the blade length from axis.

Blade-back. The cambered or convex face of a propeller blade.

Blade (Controllable). A propeller blade so constructed that its pitch-angle can be adjusted or varied during flight.

Blade Driving-face. See BLADE-FACE.

Blade (Effective pitch). The actual distance that the propeller moves forward in one revolution when working in air under practical flying conditions. This is less than the GEOMETRICAL-PITCH by the amount of the SLIP.

Blade-element Theory. The theory advanced by Drzewiecki that the total thrust of a propeller is equal to the sum of the lifts developed by a number of short airfoil sections taken along the length of the blade. Thus, the propeller blade is considered as built up of a great number of very short airfoils called "elements."

Blade-face. The face of a propeller blade, usually flat, that corresponds to the bottom surface of a WING-SECTION.

Blade (Geometrical-pitch of). The calculated distance that a propeller blade section, located at two-thirds the length of the blade from the axis, would move forward in one revolution without slip. It would be the distance traveled if the screw-propeller were turning in a threaded nut or in a solid medium. The value of the geometrical pitch is usually stamped on the propeller.

Blade (Micarta). A blade built up of paper plies saturated in a phenol resin product, similar to BAKELITE.

Blade (Multiple). More than two propeller blades are employed when a certain amount of power must be developed with a small diameter propeller. Three or four blades are common with large engines where the propeller diameter is limited by structural reasons.

U.S.A. Air Corps

(Continued from page 149)

When everything was ready, Lowe, always wearing his silk hat, would climb into the flag-bedecked basket. The crew on the ground would pay out the mooring-rope from a windlass, slowly letting the balloon rise into the air. As soon as it mounted above the treetops, it became the target for every firearm that the Confederates possessed and it is said that some even threw rocks and old shoes.

After Lowe had completed his observations, he would descend and immediately confer with the high ranking officers of the army who would plan their attacks according to the information he gave them. Sometimes, the officers themselves would go aloft with him. At General Fitz John Porter's headquarters, a balloon was used on a daily tour of inspection, the General himself making over one hundred flights.

On one occasion, the balloon broke loose with several passengers aboard and drifted over the heads of the enemy who gave it a warm reception with rifle and artillery fire. After penetrating deep into Confederate territory, Lowe managed to ascend into a current of air blowing in the opposite direction and was carried back to his own lines.

In the battle of Budd's Ferry, below Mount Vernon, the first aircraft carrier came into action. It was a far cry from the gigantic aircraft carriers of our modern navy, but it served its purpose just as well.

A special platform was erected on the little steamer, *George Washington Parke Custis*, and a balloon with generating apparatus was taken aboard. When the bag was in the air, the steamer proceeded down the river near the point where a Confederate blockade had been costing the Government over a million dollars a day.

Riding high overhead, it was soon apparent to the aeronaut just how the enemy could best be defeated and how the Federal fleet could pass. He conveyed this information to his commanding officer and the blockade was broken in a few hours.

The first actual conversation from the air was carried on by telegraphic transmission from the balloon *Enterprise* while it was floating high above the city of Washington. In June, 1861, Lowe took aloft with him a telegraph apparatus and sent the following message to President Lincoln:

"This point of observation commands an area of near 50 miles in diameter. The city, with its girdle of encampments, presents a superb scene. I have pleasure in sending you this first dispatch ever telegraphed from an aerial station, and in acknowledging indebtedness to your encouragement for the opportunity of demonstrating the availability of the science of aeronautics in the military service of the country."

Now a Waco Cabin Plane at $5225.00

Here's a Standard Series four-place cabin WACO that will create a sensation in 1935. A ship with ample power and with performance features that cannot be matched at anywhere near the price. Basically it is similar to the now famous 1934 Cabin WACO. Refinements and changes have made possible new, low prices for this model SC WACO, powered as follows—

Continental	210 H.P. Magneto Ignition	$5,225.00
Jacobs	225 H.P. Magneto or Battery Ignition	5,490.00
Wright	250 H.P. Magneto Ignition	7,000.00

GUARANTEED PERFORMANCE

Engine	*Top Speed*	*Cruising Speed*	*Landing Speed*
Continental	140	122	50
Jacobs	144	125	50
Wright	148	127	52

We suggest that you make arrangements now with your local WACO dealer for a trial flight. It will not obligate you in any way. If you do not know his name, write us.

In addition to the Standard Series four-place cabin WACO, the 1935 line of WACOS will include a new Custom Series four-place cabin plane which will be announced soon. This ship will embody features which will make it the world's outstanding airplane.

THE WACO AIRCRAFT COMPANY, TROY, OHIO

WACO AIRPLANES
"ASK ANY PILOT"
WACO LEADS IN AIRCRAFT REGISTRATION

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

E. E. PORTERFIELD, JR., announces the formal approval of the Porterfield "Flyabout" by the Bureau of Air Commerce. This ship, intended to sell in the low-priced field as suggested by Director Eugene E. Vidal, is a two-place cabin monoplane powered either with a LeBlond "70" or a Velie 65 horsepower engine. Mr. Porterfield says that his company is ready to go into production immediately on a large scale and that the company has more than 150 orders now on hand. Several ships have already been delivered, including one to Balboa, Panama, Canal Zone.

BOEING SCHOOL OF AERONAUTICS, Oakland, Calif., announce that of the 96 students graduated from various courses during 1934, that 69 students, or 72 percent of the total number, have received positions in the aviation industry as co-pilots, operations and aeronautical engineers, engine, airplane and metal mechanics, instrument technicians, radio dispatchers, electricians, field clerks, traffic representatives and in other positions.

CORBEN SPORT PLANE COMPANY, Madison Airport, Madison, Wis., has just issued a new and very complete illustrated catalog describing its new planes and construction kits. A full description of the Junior-Ace, Baby-Ace, Super-Ace and the Ford engine conversion is given. We refer to the Corben advertisement appearing in this issue as to how this catalog may be obtained.

A COMPLETE survey of air transportation economics will be offered by Northwestern University in its evening school of commerce, Chicago. Thomas Wolfe, district manager of the United Air Lines, will be the instructor of the course. The survey takes up the history, development and probable future trends of air transportation, the organization and management of airlines, investment problems, traffic control, government regulation and air law.

UNITED AIR LINES claims the record of flying more passengers, more miles, more mail and more ships than any other airline in the world. It reports that a total of 147,000 revenue passengers were carried in 1934, an increase of 15 percent over the 1933 mark. It also carried 1,136,000 pounds of air-express, an increase of 143 percent over the 1933 record of 468,000 pounds. United Air Line planes flew approximately 15,000,000 miles during the year.

TRANSCONTINENTAL AND WESTERN AIR, INC., have established a new flying routine for its transport pilots. This enables the pilot to decide one hour in advance what course to fly, the most favorable altitude and the percentage of horsepower to be used in making the flight. New company regulations now require a meeting of three employes one hour before a transport plane leaves a terminal, the pilot, dispatcher and the meteorologist. Fifteen minutes before departure, the pilot receives a written weather report of the conditions over every 50 miles along the airway.

LIEUT. JOE MACKEY, celebrated stunt flyer, and Bill Sweet, popular radio and air race announcer, frequently called the "Linco Twins," have been wowing air show crowds throughout the state of Ohio.

FRANK C. MOCK, veteran of the automotive industry, widely recognized as one of America's foremost authorities upon fuel flow in carburetors, has been appointed vice president in charge of carburetor engineering, Bendix Products Corporation. He has been associated continuously with the development of the Bendix-Stromberg Carburetor since 1912. He entered the industry in 1903 as a draftsman with the old F. B. Stearns Company and designed the first Stearns car with the engine under the hood. Later, he was engaged by the Royal Tourist Car Company, the Stoddard-Dayton Company and the Thos. E. Jeffery Company.

A LOCKHEED ELECTRA of the Northwestern Airlines carried a load of six passengers and two pilots from Minneapolis to Chicago in one hour, 22 minutes, on a regular scheduled flight. Mel Fried, the pilot, pushed the airliner up to 11,000 feet, where it cruised at more than 200 m.p.h. and had the advantage of a tail-wind. Northwest Airlines is putting a fleet of modern Electra airliners on its northern transcontinental route.

A NEW transport record has been established by the Philippine Aerial Taxi Company, Manila. One of their two Bellanca Skyrockets was operated 365 days in one year.

A NEW HORNET engine, known as the Series "E," has been granted an A.T.C. by the Bureau of Air Commerce. It is a single row, nine cylinder fixed radial engine rated at 750 horsepower at 7,000 feet altitude. The weight is 1.34 pounds per horsepower, including the propeller reduction gearing. It is the same general design as the other Hornets, the improvements being largely detailed improvements such as automatic lubrication for the valve rocker arms, automatic priming, automatic control of the crankcase oil and an improved supercharger.

CURTISS-WRIGHT AIRPLANE COMPANY, Lambert-St. Louis Field, Mo., is contemplating the construction of a mammoth airplane containing 36 sleeping berths. This ship will have a span of 131 feet and a flying speed of 200 m.p.h. To make a continuous flight of 1,500 miles it may be necessary to cut the load down to 32 passengers, but on short flights it will take care of 48 passengers.

PARKS AIR COLLEGE, East St. Louis, Ill., has recently made additions to the dormitory so that eighteen more students can be accommodated. Each room accommodates three students, so that this addition adds materially to the accommodations for additional students. The college now has three dormitories with a total capacity for 225 students.

Rockets

(Continued from page 150)

able speed. Aside from the theory involved, actual tests in a partial vacuum have been made, which prove that the above is true; that a rocket motor becomes more effective as a vacuum is approached.

This, then, is the motor, once perfected, which will enable man to gain a new concept of speed, and eventually to break the bonds which tie him to the atmosphere, as in the past he broke the bonds that held him to the ground. Let us consider the rocket motor, not as an instrument to carry us to the moon or Mars, but from a cold engineering standpoint, and compare it to the gasoline engine, as applied to the airplane.

In the gasoline engine combined air and gasoline are ignited and a pressure is created similar to that produced within a rocket motor's combustion chamber. This is applied to the top of the piston, which through various bearings and rods is made to turn a crankshaft, turning a propeller and producing power by accelerating gases (the air). The rocket motor simplifies this elaborate operation greatly.

The pressure within the combustion chamber is made to accelerate the gases directly, thus eliminating all moving parts, including such intricate and inefficient devices as oil pumps, carburetors, magnetos and valves.

Both motors work on the same fundamental principal, both gaining power by accelerating gases. Due to its lack of moving parts, the rocket motor, properly designed, is 70 to 75 percent efficient, as compared to the 30 or 34 percent efficiency of the gasoline engine. With the loss due to the inefficiency of the propeller added in, the latter figure would be still lower. Add to this the fact that, once perfected, the rocket motor should be the most reliable of motors, again due to its simplicity. In addition, it could be made very cheaply.

To study the operation of the rocket motor let us consider the latest motor designed by Ernst Loebell, chief engineer of the Cleveland Rocket Society, and constructed by the society, soon to be tested. It is 20" long, and the combustion chamber is constructed of a chrome-nickel alloy.

There are four fuel inlets into the combustion chamber, slightly below its center and slanted upward. Two are to admit the oxygen while the other two admit the gasoline. Near the top of the combustion chamber there are three threaded openings. These accommodate thermocouples to test the temperature, and a pressure gauge to determine the pressure. These are used only for the proving stand tests, and are plugged when the rocket motor is actually used to propel a rocket.

At the very top of the combustion chamber is a spark plug, used to ignite the gases once only. Once started, the combustion is a continuous process.

At the bottom of the combustion chamber is the long exhaust nozzle, called the DeLaval nozzle, after its inventor. This increase in size, being somewhat bell-shaped, its largest diameter naturally being at the end farthest from the combustion chamber. By utilizing the expansion of the gases in such a way as to increase their velocity, the nozzle increases the effectiveness of the motor something like 18 percent.

All parts are highly polished to decrease the only element of resistance in the rocket motor—the friction of the gases. The combustion chamber is designed to eliminate pockets and obstructions which would tend to produce eddy currents, thus cutting down the efficiency.

The oxygen enters the combustion chamber as a gas—under its own pressure—from the tanks of liquefied oxygen. Since oxygen boils at -182 degrees Centigrade, it builds up its own pressure, which necessitates the addition of a safety valve on the line.

The gasoline enters the combustion chamber as a liquid. Instead of using a mechanical pump to force the gasoline, the pressure of nitrogen, boiling at -193 degrees Centigrade is used, and a safety valve also used to control this pressure.

END

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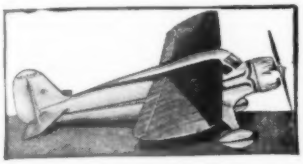
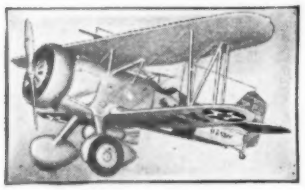
THE *New*, FAMOUS SUPER-DETAIL *Martin Bomber*



STINSON RELIANT

Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Here's a plane you'll be mighty proud to own and fly. An exact reproduction of one of the latest 4 passenger cabin planes. You'll find more unusual and different features in this plane than in any other. For example—adjustable speed arresters built into the wings, the movable cabin doors, the complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black.
Kit complete, postpaid..... $2.50

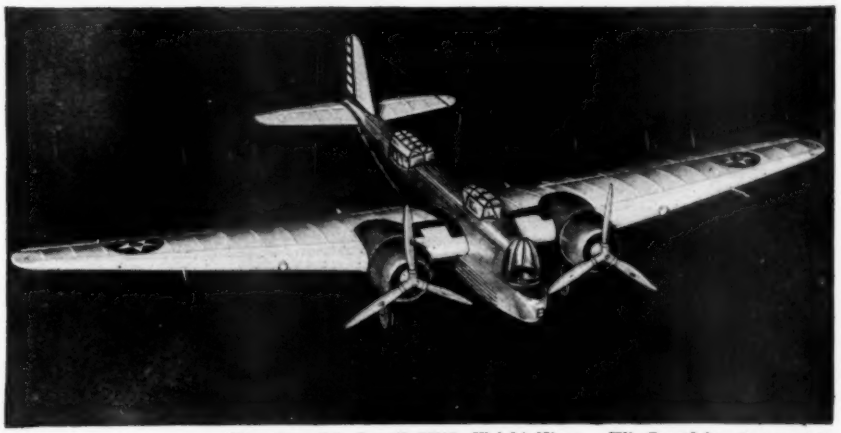


CURTISS GOSHAWK

Wingspan 23⅜", length 16¾", weight 3⅛ oz., exact ¾" scale. You've heard of this beautiful Curtiss Goshawk. Now you can build your own with the most complete kit you ever saw. This snappy little Navy fighter has many more details than you can see in the photo. Everything designed in exact scale of course. Streamlined drag ring specially designed; two detachable blade propellers, and the entire model coated with the new IDEAL high lustre finish, with silver, yellow, red and black coloring. Plenty of material is furnished.
Kit complete, postpaid..... $2.00

BOEING P-26A

Wingspan 21¼", length 18", weight 2½ oz. Exact ¾" scale. One of the newest, most advanced of all fighting planes. Fast, speedy, with full armament capable of over 240 miles per hour. This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included.
Kit complete, postpaid..... $1.75



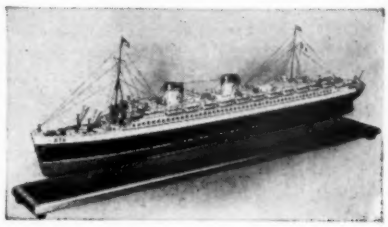
Wing Span 35"—Length 22½"—Weight 4⅝ oz. Kit Complete $3.50

IDEAL brings to you, with all the Super-Detail features and many new exclusive fittings, this famous big, powerful, mystery ship of the army. Beautifully designed, strikingly colored in high luster Olive Drab and Yellow, the Martin Bomber plane has more new and beautiful features than any model you ever saw—one of the most complete flying models ever built.

In addition to the controls which you can actually work from the cockpit—which operate elevator, rudder and ailerons just like the big planes, the Martin Bomber has retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition with removable motor sticks for flying; rudder and elevator balanced surfaces; new type freese ailerons—all in all one of the finest, most complete flying models ever built at any price.

Designed by experienced flyers—men who have spent their lives designing and building real planes, IDEAL Super-Detail planes have all the features of their big flying brothers. Also the new and exclusive Super-Detail fittings such as—ailerons, rudder and elevator can be set in any position desired for flying and controlled by cables from cabin—IDEAL bright high luster finish—pulleys—control horns—control cable—streamline drag rings—exact scale wood wheels—everything an exact duplicate of the big flying planes.

Another NEW Super-Detail model . . . the Italian liner *REX*.



29"—scale 1/32" to the foot.

An exact replica of the new and beautiful Italian liner . . . this Super-Detail 29 inch model has a shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways, 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler, sandpaper, etc. It has full sized plans with complete instructions and 7 photographs illustrating the different stages of construction. A beautiful model, easy to build, for all the hard work has been done for you. **Kit complete, postpaid.... $6.00**

***That is why you really learn the principles of aviation when you build planes the IDEAL way . . .* that is why they are exact reproductions, perfect in every detail, why experienced model builders prefer Super-Detail kits. That is why IDEAL received serial number one and was the first to be approved by the Junior Birdmen of America.**

Send the coupon today for any of the kits pictured. Everything necessary to build a big, beautiful, workmanlike flying job, included in the Super-Detail kit. You only have to follow the complete and simple instructions to obtain extraordinary results.

WHAT THE SUPER-DETAIL KIT INCLUDES:

Everything necessary to build a big, beautiful workmanlike job is included in the Super-Detail Kit. Finest materials only are used in its construction: Sheets of selected plainly printed balsa, strips of various sizes, etc., sheets of silk tissues, cement, both colored and plain dope, propeller shafts, two propellers, motor plate, rubber motor, wheels, cable cord and all other hooks, pulleys, control hinges, eyelets, washers, sand paper, celluloid, reed, wire and other small but necessary things to make the complete model exactly in accordance with the plans and instructions.

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Propellers

(Continued from page 168)

tion of this efficiency. The only thing to do then would be to modify the propeller diameter and the r.p.m. in such a way as to arrive at a reasonable value of tan. a, thus assuring an available L/D. By doing this a number of times the designer will get experience and acquire the judgment which will in the future greatly enhance the correctness of his preliminary assumptions.

It should be noted that the data applying to an airfoil of 6:1 aspect ratio will have to be considerably modified for a blade section of, say, 6″ span and of tapering thickness, and the designer should be careful to select his airfoil only from the data especially revised and supplied for that purpose, this data being the result of much comparative research.

Instead of revising our calculations, which space does not permit, we assume that there is a profile having an L/D of 33, and proceed with our second propeller *built especially for a cruising speed of 85 m.p.h. and an efficiency of 80%.*

The power-required curve shows that the thrust-hor epower is only 60. With a propeller efficiency of 80% this would call for 60/0.80 = 75 B.H.P.

The first question is: what would be the r.p.m. of our engine when delivering only 75 h.p.? The horsepower-revolution curves of well-known engines support the assumption of 800 r.p.m., a value which we shall adopt for our calculations in the absence of a certified engine performance chart.

The diameter of our special propeller then will be:

$$D = \sqrt[4]{\left(\frac{90{,}000}{800}\right)^2 \times 75/85}$$

$$= \sqrt[4]{11{,}200} = 10.3 \text{ ft.}$$

We shall use 10 ft. to facilitate our calculations. This is a considerable increase over the diameter of our first propeller.

The effective propeller disc-area is:
$3.14/4 \times [D^2 - (D/5)^2] =$
$3.14/4 \times [100 - 4] = 75.3$ sq. ft. = A

The thrust for the speed of 85 m.p.h. is:

$$\frac{375 \times 60}{85} = 264 \text{ lbs.} = T$$

The slipstream component is:
$v = T/(W/g \times A \times V)$
$v = 264/(.00237 \times 75.4 \times 124.61)$
$= 11.9$ feet per second

The effective slipstream component is $2/3 \times 11.9 = 8$ ft. per second. The circle swept by the propeller tips is $3.14 \times 10 = 31.4$ ft. in circumference. The revolutions per second are 800/60 = 13.3. The tangent of the effective pitch angle at the tip is:

Tan. a = 132.61/13.3 × 31.4 = 0.316

The effective pitch angle at the tip is a = 17° 36′.

The effective tip speed:
Vc = (V + 2/3 v)/Sin. a

$$= \frac{132.6}{.3024} = 438 \text{ ft./sec.}$$

Now, taking a blade element at ¾ radius, we have $D_1 = 0.75 \times 10 = 7.5$ ft. The circumference of the circle described by that element is $3.14 \times 7.5 = 23.55$ ft.

Tan. a_1 = 132.61/13.3 × 23.55 = .423
a_1 = 22.9 = effective pitch angle
V/(V + 2/3 v) = 124.6/132.6 = .94

The efficiency of the propeller has been assumed as 80%, therefore:
0.80 = tan. (b-a_1) × tan. a_1 (.94), or
tan. (b-a) = 0.80/(.423×0.94) = 2.01
b-a = 63.6°, and
b = 63.6 + a_1 = 63.6 + 22.9 = 86.5°
Tan. b = tan. 86.5° = 16.35
= L/D of average blade section

The section required should then have an L/D of 16.35 at, let us say, 2° incidence.

Comparing the two propellers, it is seen that the V/nD of the first (high-speed) propeller is 0.776, whereas the V/nD of the second propeller, built especially for cruising speed, is 0.93. In order to preserve the 80% efficiency at cruising speed, the pitch angle of the original propeller would have to be changed from 20.7° to 22.9°, the diameter would have to be changed from 6.8 ft. to 10 ft., and the sectional profile shapes of the blades would also have to be changed in accordance with the required L/D value.

Moreover, the second propeller could not be used for high-speed work. It is evident that it would pay after all to use the first propeller and sacrifice some of the efficiency at cruising speed.

To make sure, we shall investigate the change in efficiency of our first propeller where used at cruising speed. We shall calculate the power available for one speed only, namely 85 m.p.h., since that is the speed we are most interested in. The efficiencies intermediate 85 and 120 m.p.h. may be figured in a similar manner.

Our design speed being 120 m.p.h. and our cruising speed 85 m.p.h., the cruising speed is 85/120 = 70.8% of the design speed. The r.p.m. of the motor varies with the forward speed of the plane. This variation in r.p.m. can be obtained from Fig. 2, which gives the variation of full-throttle r.p.m. plotted against the airspeed.

For a speed of 85 m.p.h. the r.p.m. will be 90% of the design r.p.m. Therefore n = .90 × 2,000 = 1,800 r.p.m. The horsepower delivered to the propeller at this r.p.m. can be taken from the performance chart which the manufacturer supplies with the engine. In our case 184 h.p. at 1,800 r.p.m. will be a fairly close estimate.

The design V/nD for the high-speed propeller is 0.776.

For a speed of 85 m.p.h. at 1,800 r.p.m. the V/nD is (.85 × 88)/(1,800 × 6.8) = 0.610, or 610/776 = 78.6% design V/nD.

Figure 3 gives the variations of propeller efficiency plotted against variations in the design V/nD for a fixed-pitch propeller. In our case the modified efficiency is 90% of the original or design efficiency. Our new efficiency therefore is .9 × 80 = 72%, that is to say, we are operating our propeller at a loss of 8/80 = 10% efficiency.

The thrust-horsepower available then is .72 × 184 = 132 h.p. The drop in the power available curve materially affects the climbing ability of the plane and the only remedy for this condition at the present time is the variable-pitch propeller.

END

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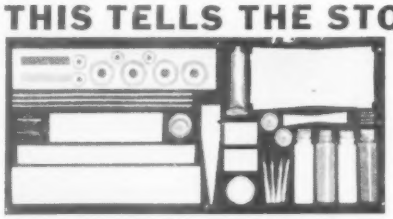

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RUMPLER C-V.
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ORDER NOW! Complete ¼" 2-Seater Kits— **75¢** EA.

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CURTISS ARMY HAWK P6E

24" Span, Weight 2¼ oz., Flies 800 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, printed instrument board, semi-scale fibre prop. **Construction Set Complete, postpaid..... $2.50**
Model ready to fly.....$25.00

CURTISS CYCLONE HAWK

24" Span, Weight 2½ oz., Color Silver

Set includes special 3¾"scale Cyclone celluloid 9-cylinder motor, celluloid wheels, silver dope, glue, printed out balsa wood, insignia, carved varnished prop., drawing, etc. **Construction Set Complete, postpaid..... $2.95**

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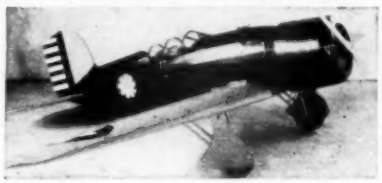
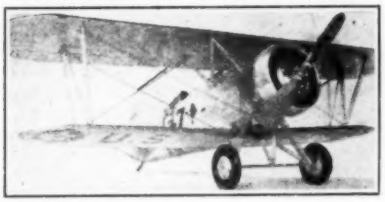
Combination Land and Seaplane Set



32" Span, Length 20", Weight 3½ oz.

Set includes all parts printed on balsa wood, turned cowl front, balloon celluloid wheels, color yellow and drab dope, full scale 35"x44" drawing, fibre prop., colored wing and rudder insignia, army lettering, etc. **Construction Set, postpaid..... $2.75**

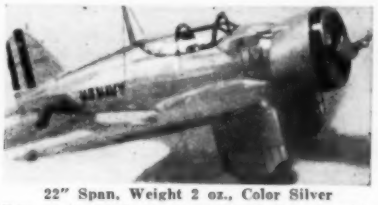
NEW BOEING F4B4 PURSUIT



22½" Span, Weight 2¼ oz., Flies 750 Feet

Set contains new tapered cowl ring and 8" carved prop., 3" celluloid motor, aluminum drag ring and motor plate, ribs and formers printed on balsa, celluloid wheels, silver discs, wing, rudder, Army and fuselage insignia, yellow and silver dope, glue, drawing and all materials. **Construction Set, postpaid..... $2.95**

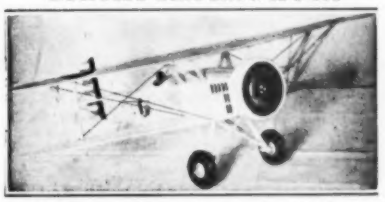
NORTHROP FT1 NAVY FIGHTER



22" Span, Weight 2 oz., Color Silver

Exact scale model of the Navy's latest 272 m.p.h. fighter. Set includes all parts printed on balsa, 3" turned cowl front, colored insignia, lettering, colored dope, drawing, etc. **Construction Set, postpaid..... $2.00**

CURTISS SEA HAWK P3A



24" Span, Weight 2¼ oz., Flies 900 Feet

Set includes 3" celluloid motor, aluminum motor plate and drag ring, balloon celluloid wheels with silver discs, printed instrument board, fuselage, wing and rudder insignia, aluminum pilot's seat, dope, glue, drawing and all materials. **Construction Set Complete, postpaid..... $2.50**

NEW CURTISS F11C4 NAVY PURSUIT

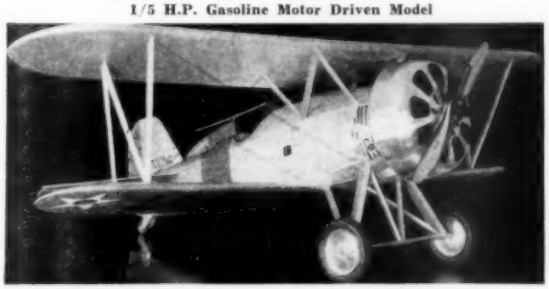
28" Span, Length 20½", Weight 4 oz., Flies 1050 Feet

1" Scale, Color: All Silver, Top-Wing Yellow, Red Striping

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 700 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder finns, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, pilot's seat, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, blue, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires; all parts, formers, wing ribs, wheelpants, etc., printed on balsa. Detail scale drawing. Set comes in attractive gift box complete. **Construction Set, postpaid..... $4.50**
Model Ready to Fly, postpaid.....$32.00

BOEING F4B4 NAVY PURSUIT

1/5 H.P. Gasoline Motor Driven Model

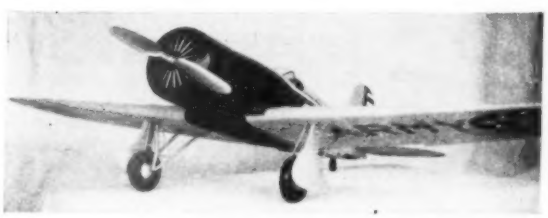


68" Span, Length 44", Color Silver

The strongest model ever made, practically unbreakable.

This is not just an ordinary large model, but one specially designed and engineered to stand the strain of the gas motor. The nearest thing to owning the real plane.
An exact scale model 1/5 the size of the real large plane rated as the finest biplane fighter in the U. S. Navy. This is the most realistic and life-like model of this size ever produced. As all the fuselage formers, wing ribs, tips, etc., are all cut out and notched for stringers, spars, etc., even a novice can make a perfect model of it with ease. Set contains 5½" non skid rubber tired cushion wheels with aluminum discs, rubber tail wheel, a special spun aluminum 10" speed, cowl ring used on the latest Boeings, silk covering material, silver and red dope, glue, drawing, axles; all wood cut to size, etc. Weight of model with motor 3½ lbs. **Construction Set Complete, without motor, postpaid..... $25.00**

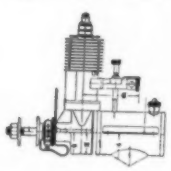
LOCKHEED P23A ARMY FIGHTER



64" Span, Length 41", Weight 20 oz., Flies 1400 Feet

The most sensational rubber driven flying model. Due to its high left wing will stay in air at very slow speed. This De Luxe set includes smooth turned 4" balloon balsa wheels, 6¾" turned motor front, 18" carved spruce varnished scale flying prop., strong paper covering, 8 ounces of special colored drab and yellow dope, paper cement, glue, etc., large scale drawing, printed out formers, ribs, etc. Model has 34" rubber motor guaranteeing long flights. **Construction Set Complete, postpaid..... $12.00**

1/5 H. P. GASOLINE MOTOR



⅞" bore, 1" stroke, used in above model. Motor comes complete with gas tank, coil, condenser, spark plug. 2 midget batteries, wiring. Price ready to run, complete.... **$22.50**

Weight 8 oz., Steel Cylinder and Piston

Specially designed unbreakable laminated propellers for this motor, 15".....$2.75
19".....$3.25

NEW CURTISS XP934 ARMY

Set has all printed parts, colored dopes, drawing, glue, wheels, etc. **Set postpaid..... $1.75**

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⅜" bore x ⅜" stroke. New air seal type ready to run with 3" x 24" seamless air tank. **Price, postpaid..... $9.50**

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Aluminum Disc Rubber Tired Air Wheels
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1¼" dia.....20c pr.
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1½" dia.....25c pr.
1¾" dia.....28c pr.
2" dia.....30c pr.

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Celluloid	Balsa
¾" dia. 8c pr.	6c pr.
1" dia. 10c pr.	8c pr.
1⅜" dia. 15c pr.	10c pr.
1⅞" dia. 20c pr.	15c pr.
2" dia. 40c pr.	40c pr.

Celluloid Air Wheels
¾" dia.....10c pr.
1" dia.....12c pr.

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Lengths	1/16	3/32	1/8
2"-3"-4"	12c	10c	20c
7"-8"-9"	14c	12c	23c
10-11-12"	18c	15c	25c

Postage 3c pair—on Rubber Tired Wheels, 4c pair

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3" dia.....60c pr.
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6⅛" dia....$2.00 pr.
7" dia....$2.50 pr.

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½" dia..... 5c ea.
⅝" dia..... 6c ea.
¾" dia..... 7c ea.
⅞" dia..... 8c ea.
1" dia..... 9c ea.
1½" dia.....10c ea.
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4".....30c	4½".....45c	2½".....15c	2½".....20c	2½".....20c
4½".....35c	5".....50c	3¼".....20c	4".....30c	4".....30c
5".....35c	5⅞".....60c	4".....25c	4½".....40c	4½".....40c
5⅝".....40c	6¼".....70c	4½".....25c	5".....45c	5".....45c
6¼".....40c	7".....80c	5".....30c	6".....60c	6".....60c
7".....55c	8".....90c	5½".....35c	7".....70c	7".....70c
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2"	20	20	20
2½"	23	23	23
3"	30	30	30

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Jests

(Continued from page 148)

pilot of an airliner who had a gun attached to a barometer in an ingenious manner. A passeger was examining it, asked the pilot what it was for.

"Oh, that," said the pilot, "is sort of an alarm clock. You see, when we are flying along in the air, the altimeter indicates the altitude. When we get down to the earth the instrument, by means of this little contraption here, causes the gun to be discharged. And this wakes me up."

There is an old query which, by the way, only Professor Einstein can answer satisfactorily. In good, sound, simple English, it is this: "How far is up?" and its mate is: "How far is down?" In a game of poker, the answer to the first question is: "The sky's the limit." The reply to the second question, I am told, was given by Will Rogers on an airliner. It seems that somebody asked him how far an airplane could dive. Will answered without hesitation, "The earth's the limit."

As I have said before, the place for an airplane is in the air. In this place, a pilot resembles the manager of a large factory. Resembles, did I say? Aye, he exceeds him. The manager may have five hundred men working under him; but the airplane pilot often has as many as five thousand men under him, not only working, but playing, studying, and sleeping, too.

Now I come to the contrary proposition. The airplane is sometimes on the ground; it is inevitably so. On occasion it rests on the ground. In such circumstances, it is the duty of somebody to go over the engine and see that everything is in working order. It was this situation that gave rise to a story I am going to tell here. It seems that a couple of mechanics employed at an airport were discussing a certain flyer who had landed at their field.

"He's a funny guy," said the first mechanic.

"How's that?" asked the other.

"When he came down, I asked him if he wanted me to go over the engine and see that it was oiled and everything."

"Yes?"

"He asked me how much it would cost. And when I told him, he said the price was too high and that he would put the grease on himself."

"And did he?"

"I'll say he did. From head to foot."

Now, in these days, no article on aviation would be complete without at least a passing reference to Col. Charles Lindbergh. Of course, some of us are old enough to remember "'way back when there wasn't any Lindbergh," but we can't help paying tribute to the man who took the "naught" out of aeronautics, and the "shun" out of aviation and made them what they are today.

It is true that aviation hasn't reached the stage where the farmer going to town with a basket of eggs can get a lift from a passing airplane, but possibly this will come in the future. But the science has reached the stage where a flyer can break a record without unduly risking his neck. In the old days, if an airplane dipped, swerved, dived, and went into a spiral, and you realized that it was out of control, you were glad that you were on the ground watching it instead of being in the air. But now, it is no uncommon experience for a man to sleep in peace while flying across the continent.

But it is still possible to get a jolt from an air-race. If you don't believe it, just try to watch one some day when you have a stiff neck.

But even journalism is getting air-minded. Just the other day I picked up the "Fly Paper," a sheet devoted to the doings and undoings of pilots. Seems as if we can't dodge flying even when we are on the ground, and the pilots are stuck on this sheet—so they say.

Then there was the woman who took her first close look at an airplane as it stood on the ground. Sez she, "Why do they use that paddle, I don't see anything to stir up?" But she was wrong. The paddle stirred up plenty more soup in one minute than she will ever stir up with a teaspoon in a hundred years.

Speed's the thing these days. If you're not fast you're out. New York to San Francisco in one day. Italian plane flies 421 miles per hour, and all the rest of it. But just the same there are times when an old horse-and-buggy is a whole lot better on a country lane than a Super-Gee-Whiz doing 350 m.p.h.

There are all kinds of stories afloat about the behavior of passengers in airplanes. But the prize one according to my way of thinking, has to do with a lady who was in a plane that was just rising from the ground. She pounced upon the pilot.

"Please, Mr. Pilot," she gesticulated, "won't you stop the airplane? I've dropped a pearl button from my coat. I see it there on the ground."

"Keep your seat, Madam," the pilot calmed her. "That ain't a button, it's a lake."

END

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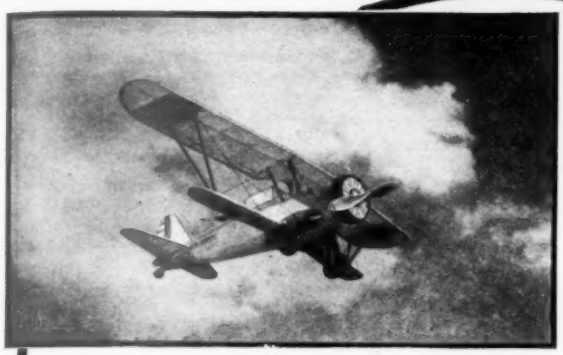

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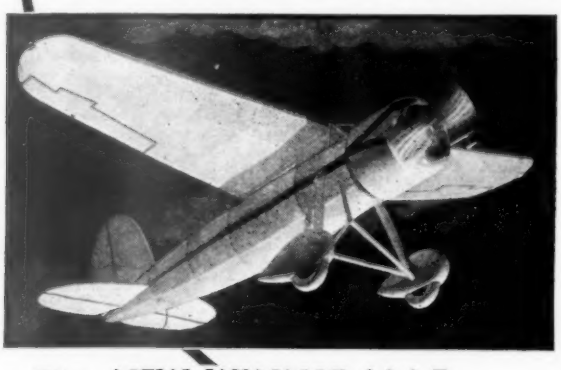

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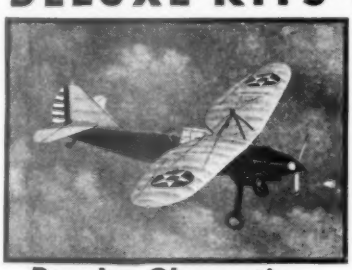

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Airy Chat

(Continued from page 142)

hundred young men and it will resume operations during the coming season, only on a larger scale. There is a camp ground, field and a two-mile lake where building, flying and other sports are conducted. Here, our correspondent says, "We eat, drink and live on aviation."

The club wants five hundred members for 1935 and if this number is enrolled, a prominent business man promises to contribute five thousand dollars for equipment. Men from 18 to 30 years are eligible if they enroll not later than March 9, 1935. Each man must have a tent, preferably a "pup" tent and must show that they have sufficient money with which to buy their meals.

Club members must pay a fee of $5.00 per year. The free camp and training will last from 30 to 60 days or as long as the campers can feed themselves.

* * *

HERE'S a new idea that might go over in a big way. W. H. Loviner, President of the Chamber of Commerce, Springfield, Ohio, being an ardent aviation fan, is endeavoring to create an air-minded public by a novel method.

First of all, he suggests that we institute an "Aviation Month," during which time speakers will address the public throughout the country on the subject of aviation and what it is all about. This program, if consistently carried out, would be more effective in the promotion of aeronautics and airplane sales than by the more usual methods, he believes. He says:

The sample-case day is over. People are not interested in just looking at a beautiful ship—they are also interested in knowing something about aviation and I have had quite a bit of experence in trying to secure able speakers from aviation manufacturers and in so many instances my letters are answered two or three weeks after their receipt and sometimes they fail to answer letters.

In other words, aviation could be increased 100 percent, if POPULAR AVIATION *would take, for instance, the month of March, 1935, and see that all the luncheon clubs throughout the country would have their four speakers for the month, from aviation manufacturers.*

This, I believe, is quite an interesting and valuable suggestion. Even though a whole month could not be devoted to the subject, an "Aviation Day" would be a valuable bit of publicity if conducted on the same general principles as Flag Day, Mother's Day, etc. Perhaps the concentration upon one day would be even better than to spread the work over a whole month. We would like to have comments from our readers on the subject of a National Aviation Day (or month) for the year 1935.

* * *

WALT BOHRER, editor-pilot of that highly interesting and entertaining aviation magazine, "Tale Spins," sends us a letter full of good will and good wishes for P.A. for which we thank him from the bottom of our hearts. Further, he has something under his hat that will be of great interest to our readers, but we'll keep our mouths shut about that until he gives us the word "Go."

To fully appreciate the original and amazing features of Tale Spins, you must see it. It is a hand-carved job from cover to cover, printed and lettered by hand with catchy sketches of various aviation happenings and really funny cartoons, all of which are laboriously whittled out by the editor-pilot. It formerly was multigraphed instead of printed but now, we understand, the reproductions are by planograph. Both Walt and Tale Spins are good friends of ours, and they will be good friends to you if you'll give them a chance.

* * *

AND just a moment! In the February issue, and attached to Mr. Stieglitz' article, was a drawing labeled: "Designed by William Stieglitz." Mr. Stieglitz informs us that he did not design this plane and that the honor goes to the Aeronautical University. Beg pardon.

J. B. R.

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The First Wright Plane May Return

(Continued from page 166)

tion of power-driven flight was responsible for their eventual success. Previously, such pioneers as Henson and Stringfellow in 1842, and almost everyone since, had sought to solve the entire problem at one sweep.

Of their many gliders and airplanes, therefore, both before and after Kittihawk, the most important ones were the glider from which branched their first successful plane, and that plane. After the final glider tests in 1902, the Wrights set themselves to developing a suitable engine for their plane. At this they were even more successful than they had anticipated. Instead of only 10 h.p., the engine developed 12 h.p. at a maximum of 1,090 r.p.m. Its weight, 179 pounds, was but 15.9 per h.p.

Through bicycle chains and sprockets, with which as bicycle builders they were familiar, the 1,090 r.p.m. were geared down to 350 for the two pusher-type propellers. These were made of glued spruce, shaped with a spokeshave. Its landing-skids, instead of wheels, acted as brakes on the soft sand. For launching, the skids were held above the sand by a monorail track shod with iron.

It was a flip of the coin, which he lost, that conferred on Orville the honor of first to fly. Wilbur, in winning the flip, earned the right of the first trial that ended in failure when the plane jumped the track, Dec. 14. Orville, in his turn three days later, aided by a 27-mile wind, flew 120 feet in 12 seconds. In the fourth and final flight, the longest that day, Wilbur covered 852 feet in 59 seconds.

Efforts to bring this plane back have been unremitting. Leading Daytonians formed a committee to win it for Dayton. The Smithsonian's efforts have been described. And in October of this year, Ex-Sen. Hiram Bingham, on behalf of the National Aeronautical Association, appointed Dr. Edward P. Warner, vice chairman of the Howell aviation commission, to head a committee to persuade Wright to return the plane.

Wright, who has always met questions concerning the destiny of the craft with kindly but apparently evasive indirectness, pointed out when informed of the Bingham committee, that the Smithsonian Institution is responsible for the presence of the Kittihawk plane in a British museum and that he could not understand why another committee had been appointed to bring its appeal to him.

Information regarding the committee, however, is not to the effect that it represents the Smithsonian, but that its purpose would be served by the return of the plane to any reputable museum in the United States, such as the one at Wright Field.

Last year, as an overture toward settling the controversy over the placard on the Langley plane in the Smithsonian, to which Wright objected, it was suggested that a group of mediators be appointed between him and the

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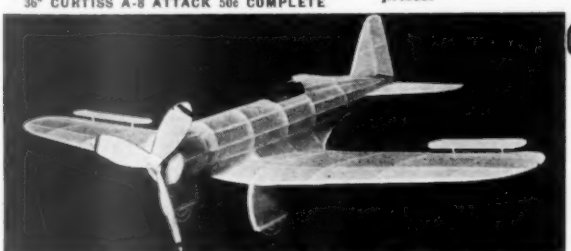

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Institution. Among those mentioned was Col. Charles E. Lindbergh. Wright signified that Lindbergh's offices would be acceptable to him.

Concerning the new committee, he said, "All I ask is a correction of history and an impartial investigation with Lindbergh as judge." Others on the Bingham committee are Capt. W. J. Tate, Kittihawk lighthouse keeper with whom the Wrights roomed; Dr. George W. Lewis, Washington scientist; Gen. Frank H. Hitchcock, former postmaster general under whom the first air mail was flown; and Earl N. Findley, editor of "Air Service," who will be secretary.

The powerful appeal of his early association with the prairie land near Wright Field may have led Orville Wright to decide on the new Wright museum as the permanent resting place of the first powered machine to fly. Here it was, just off the Springfield pike, which the structure faces, and not two miles east of it, that the Wrights conducted tests for two years after that eventful December day at Kittihawk.

These tests were carried on in an 80-acre cow pasture that now lies between Wright and Patterson Fields, both army air corps stations. Patterson Field is but five miles east of Wright.

Here the Wrights made their first long flights, both as to time and distance, and learned control to the extent that they could turn around in flight. No longer were they working with a craft that scarcely could clear the ground, but within a short 22 months after the first flight, they flew in circles for 24¼ miles on one take-off.

Before that, however, they invited newspaper reporters and others to see them fly their second craft, an improved biplane. It failed to rise for lack of the strong winds of the Kittihawk sand dunes. Next day another attempt produced no better than a 20-yard hop, and press comment was not favorable. The Wrights, knowing they could fly, had tried to give the public a convincing demonstration. They had never gone out of their way to attract publicity, and now they did all they could to avoid it.

They even went so far as to time their attempts in the half-hour intervals between passage of the Dayton-Springfield traction. But somehow the news of their improved flying circulated, and one day the Wrights saw the fences lined with people, eager for a demonstration. In the face of such curiosity the Wrights simply dismantled their plane and returned home.

But they did not give up flying. Orville went to Fort Myer and successfully met government specifications for a military plane. Wilbur took a ship to France and finally sold the rights, for cash and stock, to a group there.

The question naturally presents itself as to why, when Wright might have sent the original plane to a number of European countries, say to France, to Italy or to Germany, he selected England. The answer may be in these words of David Masters' book just off the press, "On the Wing":

"There was one exception. The British government has had many crimes laid to its door, so let it be said in favor of Great Britain that it was honorable enough to recognize that the Wright brothers were the conquerors of the air and that their patents, worked out at the risk of their lives, were valid. It was arranged that the British government should be sued so that the findings could be placed on legal record, but before the case could be brought the war came, and in the end Orville Wright magnanimously agreed to give the British government the use of his master patents for the nominal sum of 15,000 pounds. It was Orville Wright's great gesture for receiving fair play."

At least these words of an Englishman may be accepted as the British viewpoint of the reason for Wright's action in the temporary disposition of his first plane.

Of course, as might be expected in such cases, there are many who believe that it was a mistake to send this plane to England in pique and thus deprive our national museum of an outstanding historical exhibit, but at the same time, the Wrights were properly indignant at the treatment they received in this country.

Now, at the outskirts of the Wright brothers' home town, Dayton, Orville sees in finished form a building worthy of that historic craft. He cooperates with builders of the structure in fashioning anew the glider that shares much of the credit for the first successful flight, and fellow-citizens are convinced that he will bring the machine in which he made the flight, and which he and his brother built in their bicycle shop here, back to Dayton.

END

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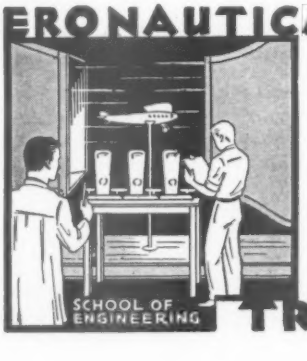

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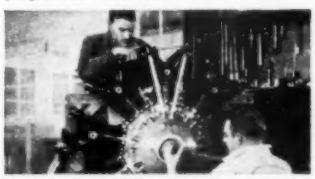

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Aero-Sportswoman

(Continued from page 152)

video by boat, but only 8 days to return via the Pan-American Airways. "And that was because we only traveled in the daytime," she said. "They were building beacons along the route at that time and when they begin to fly at night, it will only take *four* days!"

In connection with the National Aviation Day program the radio and press alike devoted much time and space to retailing the amazing history of this modern miracle and to prophesy astounding developments for the future. Stories of those early attempts and struggles to develop the industry were recounted, and the history of famous flights recalled.

The research and experiments that have produced a reliable motor, the invention of instruments such as the bank-and-turn indicator and the artificial horizon, and the adaptation of the two-way radio to the air transportation service were listed as high points in the development of flying by three famous pilots—E. Hamilton Lee, senior air-mail pilot of the United States; Jack Knight, second ranking mail pilot; and Bill Williams, another veteran of the airways with well over 1,000,000 miles of flying to his credit.

They also prophesy that within the next ten years, we will see trans-oceanic flying on regular schedules, passenger cabins super-charged to provide sea-level atmospheric and pressure conditions in the stratosphere, and fog-dispelling and de-icing devices that will insure regular flying schedules regardless of weather conditions.

If they are right, and in the light of the last ten years who would dare to scoff at the possibility, then our good friend, Mr. Fredrick H. Deknatel, may be able to realize the ambition that he has so often expressed to us in the last five years—to have breakfast in New York and to dine in Paris on the same day!

* * *

In December we had the fun of flying to Kenosha, Wis., with Ruth Wakeman to have lunch with Ruth Harmon, a new and enthusiastic member of the Ninety-nine. Then in the first week of January, Miss Harmon returned the call by flying down to a luncheon meeting of the organization at the Municipal Airport in Chicago.

Mrs. Wakeman, who was visiting in Coldwater, Mich., for a few weeks before leaving for her new home in San Francisco, flew back to the meeting in her new Fairchild-24 and brought Alice Hirschman with her.

Phoebe Bell Terry, Vi Crosbie, and Gayle Pond, Chicago pilots, were on hand to greet the girls when they flew in. Dr. Agnes Sharp, analytical psychologist, who believes that "flying is a good emotional outlet" and who is planning to join the ranks of the fledglings in the near future, was a guest at the luncheon.

Alice Kirschman, one of the Amelia Earhart hat-contest winners and governor of the North Central Section, is the girl in the Daisy Air Rifle advertisement in the December issue of AIR-WOMAN. She tells that her advertising proved so successful with her youthful audiences at every airport that she visited on the Indiana and Michigan Air Tours last year that the company is planning to buy a ship and send her out next summer to entertain small boys all over the country, which incidentally, would seem to prove that aerial advertising is still an effective medium.

* * *

The question of a lake-front airport in Chicago, which has been the object of great concern to aviation authorities for several years, has been the subject recently of considerable "front-page" publicity.

It is a serious handicap to the airlines, when their passengers who have come from New York in 4 hours, or from Los Angeles in 12 hours, find that they must spend another hour on a bus to reach the business section of the city. Nor is it any less a problem for the private flyer who wants to go some place in a hurry.

Let us say, before we are questioned on that last statement, that we realize that there will not be hangar facilities for private flyers on such a field. But it would be a simple thing to have the ship ferried in from some out-lying field when it was wanted. Using a little imagination, we can visualize a great many business men of the future commuting to their homes in just this way.

But to be more practical, we would like to relate just one small, but concrete example of how much time might be saved by a downtown landing-field and why we are an avid supporter of the idea. When we flew to Kenosha recently, it took an hour and a half to get to the airport and *twenty* minutes to fly to Kenosha!

END

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1x1..... 2 for.... 5c
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¼x¾x5.....1 for 1c; 6 for.... 5c
⅝x1x7.....1 for 2c; 3 for.... 5c
¾x1x8.....1 for 2c; 3 for.... 5c
¾x1¼x12...1 for 3c; 2 for.... 5c
1x1½x12....1 for 6c; 2 for....11c
Reed
3 ft..... 1c
Wooden Wheels
½", pair.....1c
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1/16x1/4x15.... 1 for 1c
Dozen 8c
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1"..... 5c 1¾"..... 7c
2"....10c 3"....17c
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1/16x6.....doz. 5c
⅛x18.....2 for 3c
WIRE
2 ft. 1c 25 ft. 10c
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24 and strips..... 5c
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1 doz. ¾ and ¼..... 1c
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REED.....2 ft. 1c
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5"..... 5c 6"..... 6c
7"..... 7c 8"..... 8c
10".....10c 12".....12c

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Grudge Jumpers

(Continued from page 158)

Repairs to the silk of the parachute, to the shroud lines, and the seams must be made by sending the 'chute to a central army repair depot. The inspector and rigger is allowed to make repairs to the pilot 'chute and its mechanism and to seat pads and harness, but not to the lines, line fastenings, nor to the silk of the parachute itself.

Rubbers on the inside of the pack seat, which hold the suspension lines in place, are tested and replaced if necessary. On a twenty-four-foot pack there are eight of these rubber loops, through which the shroud lines are drawn to prevent tangling.

After inspection is finished, the 'chute sections are carefully folded, with a median line down the center, and half the sections on one side and the other half on the other side of this line. A tunnel through the silk runs straight through from the edge of the skirt to the top of the 'chute, if properly folded. The folds must be so exact that there are no wrinkles to interfere with the rush of air through this tunnel.

Both corners of this skirt are now folded over to the exact size of the pack. Three sandbag weights are laid over the folds along its length to hold it in place.

Next the main lift webs of the harness are placed so they extend across the pack. The pack is then pulled up close to the skirt of the 'chute, so the suspension lines can be pulled through the rubber loops which hold them ready for use. In pulling these lines through the loops, care must be taken that the lines do not tangle or twist.

Each half of the lines is kept separated in the hand until pulled into place. You can follow the exact fold of a line from the start of the loops to the end, first inside the loop and then outside, straight across.

This is one of the most difficult parts of the packing and it is extremely important. Twisted or tangled lines can delay or prevent the opening of the 'chute, more than any other one detail. About one foot and a half of clear line is left to be folded loosely over the top of the loops for clearance.

A square metal folding iron the exact width of the pack is used to fold the parachute skirt. The first fold is marked off in the proper width for folding. Then the iron is used to pull forward each fold in the right proportion without disturbing either the weighted lengths of silk skirt still to be folded, the looped lines or the already folded portion of the skirt.

Although it is not a part of the regulation army packing method, commercial packers have found that they can make a smoother, tighter pack by marking the first fold a little shorter than the folding iron. This puts the thick part of the 'chute, with its heavily bound edge, back a little from the edge of the pack. The accordion folded 'chute skirt in a square of neat proportions is then placed on top of the looped lines, with the apex of the canopy on top.

Rip-cord inspection is vital. Although it is called a "cord," it is really a length of wire, with a metal handle at one end and stout pins soldered on the other. These pins are made of the heaviest grade of piano wire. They must be straight and clear of rust. The wire runs through a housing of ordinary flexible metal tubing. This metal tubing is fastened to the harness.

Silk cords are next threaded through the grommets. These are metal eyelets which fit over the pack cones through which the rip-cord pins are thrust. The flaps are folded over, and these silk cords are passed through the grommets in the outer pack flap. The sides of

RECORDS

THE STRATOSPHERE

36" Span Weight 1½ Oz.

For the real thrill in models fly this remarkable airplane. Broughton flying a Stratosphere at N.A.A. weight rule exceeds record by four times with a flight of 55 minutes. Using Bunch materials 100% Broughton wins L. A. Junior Birdmen outdoor championship. Salisbury wins L. A. indoor championship. Monroe wins L. A. indoor junior championship. Buy from the CHAMPIONSHIP COMPANY. The "Complete in every respect" Stratosphere Kit, postpaid, insured $2.25. Catalogue, 3c stamp.

BUNCH MODEL AIRPLANE CO.

"Models that really fly"

2303 S Hoover St. Los Angeles, Calif.

A company owned and operated by Licensed Transport Pilots and Aeronautical Engineers.

The APRIL *Issue*

APRIL marks the opening of the flying season in the Northern states, so for this reason, the April issue of POPULAR AVIATION will be essentially a flying issue, devoted to open air activities.

But—our other departments will not be neglected. There will be technical and general interest articles of unusual interest and value as well as the usual departments devoted to lightplane and model building. The April issue of P.A. will be another outstanding issue of great interest.

ON ALL NEWSSTANDS MARCH 10

COVER—The front cover of the April issue will carry a picture of the Corben Super-Ace in full colors.

the pack are then pulled into place by these cords, and the pack cones are locked into the grommets by inserting pins of a temporary rip-cord.

Next the pilot 'chute is inserted into the pack. Pilot 'chute lines enter the pack on the opposite end from that of the rip-cord housing. The rigger holds the pilot so the main spring or eye-loop of the mechanism is toward him. The skirt is folded just inside the frame as this spring is closed. Then the pilot 'chute is inserted point down under the flap, so it is forced open by its own spring as soon as the pack opens. Next the suspension lines of the pilot are folded and tucked in so they will not tangle.

Outside flaps are pulled up and fastened. Elastic flap cords fastened at one end to the back of the pack carrier, are hooked across these flaps in such a way that they will pull the flaps back when the rip-cord is pulled. This keeps the pack flaps from interference with the opening 'chute.

All temporary cords are removed and the substitute rip-cord is replaced with the one which was previously tested. The pins are sealed by a turn of cotton cord under their ends. The other end is wrapped and tied around the wire and the ends tied together. The knot is drawn into a metal seal and pressed tight with the packer's official inspection number.

Once in a while, a rip-cord line catches on something in the plane and the pins slip out of the cones. Even in a closed plane the bulk of an unfolded 'chute would be awkward and dangerous. One man whose 'chute opened while in the ship, was pulled through a camera opening, fifteen by twenty inches, and badly hurt.

To avoid such accidents, a test was devised. The housing through which the wire runs is sewed to the harness to prevent damage to the rip-cord. This wire must be long enough to allow for the stretch of the flexible housing when the weight of the man who wears the 'chute pulls it out. The test consists of putting full body weight on the seat pack while holding the harness up. If the pins move in their eyelets, the rip-cord is too short to be safe.

With this detailed care in packing parachutes, no wonder the custom of "grudge jumping" has gone—completely unnecessary, since very packer is willing to try out his own pack. The final test at Chanute Field Parachute School, when the student packer jumps with a parachute of his own packing, is voluntary. Most of them want the experience, after completing their work in the course.

Professional 'chute jumpers do not usually bother to keep the rip-cord after it is pulled and the parachute is released. So often the jumper needs both hands to guide the 'chute by pulling the shroud lines during his descent, and the rip-cord is thrown away.

END

Emergency

(Continued from page 161)

soldiers but for the disciplinary value and for efficiency.

The membership and qualifications of the group indicate the serious intentions of the unit. Rank has been assigned on the basis of flying abiliy. The commanding general, Florence Lowe Barnes, known in aviation circles as "Pancho," has held the world's speed record for women and is the only woman pilot member of the Associated Motion Picture Pilots, who furnish movie thrills.

First Lieutenant Viola Neill, R.N., is a private pilot, qualified Red Cross first-aid instructor, and national medical officer of the Reserve. Dr. Kittredge, flight surgeon, is a student pilot and Red Cross first-aid instructor. Captain Bobby Trout, chief of staff, is a transport pilot, holder of endurance records, and qualified first-aid worker.

First lieutenants are Myrtle Mantz, private pilot, radio operator, first-aid worker; Eileen Curley, R.N., private pilot, first aid; Patty Willis, private pilot, first aid, holder of a Red Cross life-saving certificate; Alice Jane Kelly, private pilot, first aid.

Second lieutenants are Vivienne Culver, R.N., solo pilot, first aid; Ruth Van, R.N., student pilot, first aid; Pauline Collins, R. N.

END

DIAMOND SUPPLIES for DEALERS

BEST QUALITY · LOWEST PRICES · SUPPLIES · KITS · ACCESSORIES

If 18" lengths are desired, take ½ of 36" length price.

If 3" widths are desired, double price of 2" widths.

Thinner same price as clear dope.

BALSA STRIPS 36" Lengths

Per 100	
1/32x1/16	12c
1/16x1/16	14c
1/16x⅛	20c
1/16x3/16	25c
1/16x¼	27c
3/32x3/32	25c
⅛x⅛	30c
⅛x3/16	50c
⅛x¼	55c
⅛x⅜	65c
3/16x3/16	50c
3/16x¼	60c
¼x¼	85c
¼x⅜	$1.25
¼x½	1.60
⅜x⅜	1.90
½x½	2.25

BALSA SHEETS 36" Lengths

1/64x2, 10 for..14c
1/32x2, 10 for..15c
1/16x2, 10 for..18c
3/32x2, 10 for..21c
⅛x2, 10 for....23c
3/16x2, 10 for..32c
¼x2, 10 for....42c
½x2, 10 for....75c

BALSA PLANKS 36" Lengths

1x1, each..... 6c
1x1½, each..... 8c
1x2, each.....15c
1x3, each.....20c
1x6, each.....35c
1½x1½, each...25c
2x2, each.....25c
2x3, each.....33c
2x4, each.....45c
2x6, each.....60c
3x6, each.....$1.25

STANDARD PITCH BALSA PROPELLER BLOCKS Per Dozen

¾x½x5.... 5c
½x¾x5.... 5c
½x¾x6.... 6c
¾x1x7.....14c
¾x1x8.....18c
⅞x1x9.....25c
⅞x1¼x10....30c
⅞x1¼x12....35c
1x1½x12....40c
1x1½x15....53c

BAMBOO

1/16 sq. x 14, 1 gross for.....20c
1/16x⅛x11, 1 doz. for.....5c

REED

1/32 or 1/16 dia., 50 ft. for.....18c
3/32 or ⅛ dia., 50 ft. for.....20c

DOWELS

1/16 dia. x 12" per doz., 100 for 55c.
25 for.....20c
⅛" dia. x 36" per doz., 100 for $1.50.
25 for.....45c
3/16 dia. x 36" per doz., 100 for $2.25.
25 for.....75c

COLORLESS CEMENT

1-oz. bottles, per ½ doz.....25c
2-oz. bottles, per ½ doz.....45c
4-oz. bottles, per ½ doz.....75c
1 pt., each.....45c
1 qt., each.....75c
1 gallon, each $2.00

CLEAR DOPE OR BANANA OIL

1-oz. bottles, per ½ doz.....23c
2-oz. bottles, per ½ doz.....40c
4-oz. bottles, per ½ doz.....70c
1 pt., each.....40c
1 qt., each.....65c
1 gallon, each..$1.75

SHEET CELLULOID (Transparent.)

12½x16, each....19c
6x8, doz.....65c

5 Inch Solid Kits $4.10 gross

5" solid model Kits, complete with all parts printed, full-size plan, insignia sheet, cement, and sandpaper sell very nicely at any price up to 10c. Choice of Boeing P-12F, Texaco Sky Chief, Spad, Fokker D-VII, Lockheed Vega or S.E.5. 50c per doz., $4.10 gross.

2 In 1 Kit-15" Flying Scale Models

of Fokker D-VII and Curtiss Robin in one box with large quantities of materials, complete with carved prop, wire parts bent, full-size plan and instructions, printed sheet, large bottles of cement and dope. Boys, order these kits again and again.

3 for $1-12 for $3.60

HOW TO ORDER No orders for under $2.50. All orders shipped express, charges collect. No C. O. D. orders.

COLORED DOPE

White, yellow, orange, blue, red, green, olive drab, black, silver, gold or grey.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, ½ doz....$1.00
1 pt., each.....50c
1 qt., each.....85c
1 gallon, each.....$2.25

HIGH-GLOSS

To shine up colored models.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, ½ doz....$1.00

WOOD VENEER

(For scale model work.)

20"x30", 3 sheets for.....25c

JAPANESE TISSUE

White, per doz.....12c
Colored, asst., per doz....13c
All colors.

GENUINE SUPERFINE TISSUE

(Cover your champion endurance ships with this paper.)

18x24, per doz.....75c

FRESH PARA RUBBER AA GRADE

1/32 sq., 225' skeins.....25c
.045 sq., 225' skeins.....35c
3/32 flat, 225' skeins.....35c
⅛ flat, 225' skeins.....40c
3/16 flat, 225' skeins.....70c
Per pound, any size....$1.25

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back. Per doz., 36c; 100 for $1.75

WIRE, STRAIGHT LENGTHS

Nos. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15 or 16, 100 ft., ass't sizes.....25c

THRUST BEARINGS

Small or large, each....2c
Per doz., 18c; per gross..75c

MODEL PINS

Per doz. pkgs.....35c

SANDPAPER

Per doz. pkgs.....25c

WASHERS

⅛ or ¼ dia., 1 gross....10c

3" DIA. CELLULOID MOTOR AND DRAG RING COMBINED

(First time on market.)

Special price, 3 for....$1.00

CELLULOID PANTS

For ⅜" or 1" wheel, ½ doz.....50c
For 1⅛" or 1⅜" wheels, ½ doz.....75c

Fresh Rubber, A Grade

3/32 flat, skein, 250 ft...20c
⅛ flat, skein, 250 ft.....25c

DUMMY RADIAL ENGINES (Celluloid, 9 cylinders.)

1½" dia., ½ doz. for....80c
2" dia., 3 for.....65c
3" dia., 3 for.....85c

CELLULOID WHEELS

¾" dia., pr., per doz....24c
1" dia., pr., per doz....25c
1⅜" dia., pr., per doz....35c
1⅝" dia., pr., per doz....60c

BALSA BALLOON WHEELS (Machine turned.)

½" dia., per doz..... 9c
⅝" dia., per doz.....11c
1" dia., per doz.....14c
1⅜" dia., per doz.....19c
1⅝" dia., per doz.....38c
3" dia., per doz.....85c

SHEET ALUMINUM

.002 thick, 5 ft. for.....35c
.005 thick, 5 ft. for.....50c
.010 thick, 5 ft. for.....75c

ALUMINUM LEAF

.0003 of an inch thick, 3½" wide, 100 ft. for.....35c

ALUMINUM TUBING (Special 1/100" wall.)

1/16 O.D., 5 ft.....30c
3/32 O.D., 5 ft.....32c
⅛ O.D., 5 ft.....32c
3/16 O.D., 5 ft.....40c
¼ O.D., 5 ft.....45c

ACCESSORIES

Aluminum Cowls

Anti-drag rings, closed N.A.C.A. or open N.A.C.A.

1½", 3 for.....25c
2", 3 for.....35c
2½", 3 for.....43c
3", 3 for.....55c

Die-cast Bombs

¾" long, 3 for.....10c
1¼" long, 3 for.....20c
3" long, 3 for.....35c

2-bladed Props (Die Cast)

1½" long, 3 for.....20c
2½" long, 3 for.....35c

3-bladed Props (Die Cast)

1½" long, 3 for.....25c
2½" long, 3 for.....35c

Pursuit or Swivel Machine Guns (Die Cast)

¾" long, 3 for.....10c
1" long, 3 for.....15c
1¾" long, 3 for.....25c

Die-cast Wing and Tail Lights, 3 Pcs. to a Set

For 12" model, 3 sets....20c
For 15" model, 3 sets....40c
For 20" model, 3 sets....60c

Carved Props, Holes Drilled

5", 3 for.....9c
6", 3 for.....11c
7", 3 for.....14c
8", 3 for.....17c

FREE WITH EVERY $5 ORDER 1 DOZ. INSIGNIA SHEETS

DIAMOND MODEL SUPPLY CO.
Dept. 403 915 Saratoga Ave., Bklyn. N.Y.

Gates Circus

(Continued from page 154)

straight and level while the pilot with the ladder is to approach from behind and above, and put the ladder in the hands of the stunt man.

So, when Brooks approached from behind, I was not paying any attention to him but flying my own ship as smoothly as possible. Phil was standing against the cabane tower on my upper wing, but Brooks came up a little bit fast, and seeing that he was about to pass us, throttled down. For some reason, his ship settled into mine before any of us realized what was happening. His lower wing hit Phil on the head, and he fell on the wing, holding on to the cabane tower and wires. The ladder dangled down over the trailing edge of my upper wing but I immediately started nosing down, trying to get away from Brooks.

This caused the ladder to drag into my aileron and lodge between the aileron and wing, at the inside corner. I could not move my aileron as I had Phil's weight to hold up and if the ships changed positions relative to each other, we would then be worse off than ever.

How long we stayed tied together, a few inches from each other, I am not sure. I braced both hands and my knees against the stick as much as possible, with my feet still on the rudderbar, and started pulling away from Brooks. I was looking up at him and he looked down at me.

If the expression on my face indicated how I felt, I must have looked funny to him, but I will say, he certainly was not laughing at the time.

The "pull" tore about one-third of my aileron to kindling wood. All that kept it together inside was the covering, but the ladder came loose and we were far apart in a second.

It seemed to me, that the ladder snapped back up to him like a rubberband. We were back on the ground in a few minutes, me with a busted aileron, Phil with a cut head, and Brooks with his customary chuckle.

I trimmed off the broken aileron parts and after smoking a cigarette, I was ready to start all over again.

We went up and made the change, but I watched that Billy Brooks every second. He was a good pilot, and the whole incident was just a freak accident.

This ladder act may seem to be an easy, safe and sane performance to the spectators at a distance, but it frequently is mighty hazardous.

After reading the accounts of the near disaster that evening in the newspapers, I could not figure out whether we were supposed to be heroes or death-defying fools, but I realized that it must have given a big kick to the crowd that witnessed the incident. I have had a number of experiences that have given me more of a thrill, yet did not look near so much like a close call.

END

DEALERS AND JOBBERS ONLY

Only the highest grade materials used. Take advantage . . . lowest prices for a limited time. Order now! Large stock on hand. Fast service.

36" SHEET BALSA

1/32x2	100 for	$1.50
1/16x2	" "	1.75
3/32x2	" "	2.00
1/8x2	" "	2.25
3/16x2	" "	3.00
1/4x2	" "	3.50
1/32x3	" "	2.50
1/16x3	" "	3.00
3/32x3	" "	3.25
1/8x3	" "	3.75
3/16x3	" "	4.75
1/4x3	" "	5.50

No less than 50 of a size.

36" STRIP BALSA

1/16x1/16	1,000 for	$1.50
1/16x1/8	" "	1.75
1/16x3/16	" "	2.75
1/16x1/4	" "	3.00
3/32x3/32	" "	1.75
3/32x1/8	" "	2.50
1/8x1/8	" "	2.75
1/8x1/4	" "	5.00

No less than 500 of a size.

PROPELLER BLOCKS

5" 1/2x3/4	100 for	$ .50
6" 1/2x3/4	" "	.50
7" 5/8x1	" "	.75
8" 5/8x1	" "	.85
10" 3/4x1 1/8	" "	1.50
11" 7/8x1 1/2	" "	2.00
12" 7/8x1 1/2	" "	2.40

THRUST BEARINGS

Small	1,000 for	$2.00
Large	" "	2.75

36" PLANK BALSA

1x1	10 for	$ .53
1x1½	" "	.70
1x3	" "	1.20
2x2	" "	1.80
1x6	" "	2.50
2x6	" "	4.50

TURNED HARDWOOD WHEELS

½"	1,000 for	$1.00
¾"	" "	1.25
1"	" "	1.50
1½"	" "	2.00
1¾"	" "	2.75

HARDWOOD NOSE PLUGS

½x½	1,000 for	$1.50
½x1	" "	3.75

CEMENT OR CLEAR DOPE

1 gal. cans.....$1.50

JAP. TISSUE, 20x24

White	100 for	$ .75
Colored (all colors)	" "	.85

BIRCH DOWELS

1/8x36	100 for	$ .75
3/16x36	" "	.90
1/4x36	" "	1.10

FRESH RUBBER

1 lb. spool, any size $ .80

BRASS EYELETS

1/16 O.D.	1,000 for	$ .90
3/32 O.D.	" "	.85

Ordering instructions: No orders under $5.00. Add 5% for packing. Order only in quantities mentioned. Terms: Cash with order or C.O.D. orders include 1/3 cash with order. No further discounts on orders. All orders shipped express collect. Write for prices of articles not listed. State quantities desired.

RELIANT MODEL SUPPLY CO., Dept. 303
152 McKibben St. Brooklyn, N. Y.

Wiley Post, famous 'round the world flier, points with pride to another aviation triumph—the Wiley Post plane.

The Wiley Post Plane

A low price, consistent with a high grade product—a product that both Uncle Sam and Wiley Post OK.

$1692.00

Immediate delivery.

HERE is the finest light-weight twin-seated dual-controlled ship on the market. It is a Ford-powered craft made for training work or for sportsmen pilots. Dealers wanted who can handle exclusive franchises in their territory.

Wiley Post planes are equipped with a Ford (Model A converted) engine. Motor repairs can be made without loss of time for standard Ford parts are available everywhere at a minimum cost.

Wiley Post planes are government licensed and are submitted to a gruelling inspection before the ship takes off on its initial flight. Write and get the details and you, too, will point with pride to your ship—the Wiley Post. We're sure you will want one.

Wiley Post Aircraft Corp.

Approved type certificate No. 561.

Wiley Post Airport
Oklahoma City

All-Wing Plane

(Continued from page 163)

of the trailing edges and the diverging air-flow very visible when idling on the ground.

This characteristic may not be achieved with a heavier wing-loading. The lateral and the directional stability is good, the longitudinal stability may be improved by the standard method of eliminating the dead center of the elevator control. The vision is not as good as in standard airplanes.

But, its compactness and structural advantages are outstanding inherent advantages that make the all-wing plane the obvious solution of the air-flivver problem. The possibility of employing deep ribs and sturdy spars of short span marks the end of wing-stripping and similiar troubles.

A pusher or twin-engined flying wing with a three- or four-wheel landing-gear may be the future development of the all-wing airplane, and in case with a low wing-loading, the solution of the AIR FLIVVER. END

ENGINEERING DEGREE IN TWO YEARS

B.S. Degree in Aeronautical, Civil, Chemical, Radio, Mechanical or Electrical Engineering in two years. Located in an industrial center with that Engineering atmosphere. Earn board. Low tuition. Enter March, June, September, December. Catalog.

INDIANA TECHNICAL COLLEGE
242 East Washington St., Fort Wayne, Ind.

All-Metal Airships

(Continued from page 152)

with lionol. Duralumin is naturally almost non-porous, and the lionol coating renders it, for practical purposes, entirely so.

Riveted to the cover on the inside and spaced at intervals of eighteen inches along the contour are circular ribs which hold the hull in shape. These ribs are made of twelve-gauge aluminum. There are no cross braces, no other internal structure, the strength of the duralumin hull making further reinforcement unnecessary. The fact that the ship has no rigid frame permits the expansion of the duralumin cover without throwing additional stresses on the hull.

One balloonette is used to care for the expansion and contraction of gas in the hull. It occupies 20% of the ship's gas capacity. With this exception, the entire inside of the hull is utilized as a gas container. In addition to increasing the gas capacity about three times over that of a ship of similar dimensions built in the ordinary way, the weight of compartment framework and surfacing is eliminated, thereby effecting great economy in weight and construction cost.

This is made possible by the air-tight construction of the metal cover, and by the fact that compartments are not essential as a safety factor, since any ordinary hole in the cover would result only in a very slow loss of inflation gas, as previously explained. A further economy of weight is attained by the fact that no ballast is necessary for a metal ship to take care of saturation during wet weather, as is the case with a cloth bag.

It is estimated that this entire hull can be constructed for one-half the cost of the balloon cloth used in a non-metal dirigible.

Instead of the usual position of dirigible propellers—below the hull—the new ship has its propeller situated in the nose of the shell. A Kiefer centrifugal blower type will be used, and will be powered with a 2,800 horsepower gasoline motor of special design. The advantage of this position is that it will create a vacuum in front of the vessel by displacing the air, and a slip-stream around it. Streamlined according to the latest principles, the craft is expected to develop a cruising speed of 120 miles per hour. Its cruising radius will be around 3,500 miles.

A new type of steering is also being perfected for the dirigible. Although the first ones will probably be equipped with the usual type of fins and rudder, it is planned to do away with these by the use of a motor-driven propeller mounted on a swivel in the tail of the

HEATHE Is Giving Away 5000 Kits

GUARANTEE
Money Back if Not 100% Satisfied

If 36" lengths are desired, just double 18" price and add 10c extra postage to order.

18" BALSA STRIPS

1/32x1/16	50 for .05
1/16x1/16	50 for .05
1/16x1/8	26 for .05
1/16x3/16	20 for .05
1/16x1/4	17 for .05
3/32x3/32	21 for .05
1/8 x1/8	20 for .05
1/8 x3/16	14 for .05
1/8 x3/8	8 for .05
1/8 x1/4	10 for .05
3/16x3/16	10 for .05
3/16x1/4	8 for .05
3/16x3/8	6 for .05
1/4 x1/4	8 for .05
1/4 x3/8	5 for .05
1/4 x1/2	4 for .05
1/2 x1/2	3 for .05

BALSA PROPELLER BLOCKS

¾x½x5	9 for .05
½x¾x5	7 for .05
½x¾x6	7 for .05
⅝x1x7	3 for .05
¾x1x8	2 for .05
⅞x1x9	2 for .06
¾x1¼x10	2 for .07
¾x1¼x12	1 for .06
1x1½x12	1 for .07
1x1½x15	1 for .07

18" BALSA SHEETS

1/64x2	5 for .10
1/32x2	7 for .10
1/16x2	7 for .10
3/32x2	6 for .10
1/8 x2	5 for .10
3/16x2	4 for .12
1/4 x2	3 for .11
1/2 x2	2 for .12

(For 3" Width Double 2" Width Cost.)

18" BALSA PLANKS

1"x1"	1 for .07
1"x2"	1 for .11
1"x3"	1 for .15
1"x6"	1 for .25
1½"x1½"	1 for .15
2"x2"	1 for .20
2"x3"	1 for .25
2"x6"	1 for .45
3"x6"	1 for .75

COLORLESS CEMENT

1 oz.	6c
2 oz.	11c
4 oz.	16c
1 pt.	50c
1 qt.	90c

BAMBOO
1/16 sq. x 14.35 for .05
1/16x1/4x11, 1 dz. for .06

HEATHE GLOSS

2 oz.	14c
4 oz.	23c

WIRE—STRAIGHT LENGTHS
All sizes, 6 ft. for..3c

WASHERS
(⅛" or ¼" dia.)

1 doz.	2c
1 gross	12c

RUBBER
1/32 sq., 30 ft. for 5c
.045 sq., 20 ft. for 5c
3/32" flat, 20 ft. for 5c
⅛" flat, 17 ft. for...5c
3/16" flat, 12 ft. for 5c

INSIGNIA SHEET
12 pr. and rudder and tail markings with gummed back, each only 5c

MODEL PINS
Per pkg. 5c

20" PLANS
Full-size plans, complete with large instruction sheet, 3 full-size views and all ribs and formers.

Northrop-Gamma
Spad
Vought Corsair
Curtiss Swift
15c Each—3 for 40c

SHEET ALUMINUM

.002 thick, sq. ft.	.08
.005 thick, sq. ft.	.10
.010 thick, sq. ft.	.17

ALUMINUM LEAF
.0003 of an inch thick
3½" wide, 5 ft. for 5c

ALUMINUM TUBING
(Special 1/100" wall.)

1/16" O.D., per ft.	9c
3/32" O.D., per ft.	7c
1/8" O.D., per ft.	8c
3/16" O.D., per ft.	10c
1/4" O.D., per ft.	10c

WOOD VENEER
(For scale model work.)
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Small or large, 2c ea. or 15c doz.

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(Machine Turned)

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¾" diam., per pr.	4c
1" diam., per pr.	5c
1¾" diam., per pr.	7c
1⅞" diam., per pr.	12c
3" diam., per pr.	20c

15" FLYING SCALE Model Plans

Curtiss Robin	.05
Fokker D-VII	Each

ALUMINUM COWLINGS

Size	Drag	Closed	Open
1½"	20c	26c	28c
2"	25c	25c	25c
2½"	28c	30c	30c
3"	30c	35c	35c

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2 oz.	10c
4 oz.	15c
1 pt.	45c
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Curtiss Robin

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2½"	15c ea.

Pursuit Machine Guns

¾" Pur. Gun	5c ea.
1" Pur. Gun	10c ea.
1¾" Pur. Gun	15c ea.

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1" long...	10c ea.
1¾" long...	15c ea.

Die-cast Wing and Tail Lights
3 pc. to a set for
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15" model..20c ea.
24" model..30c ea.

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7"	12c ea.

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ship. Shifting the position of the propeller will alter the direction of the ship. As well as steering, the propeller will also aid in propulsion, and give added speed to the craft. The motor which powers this steering device will weigh no more than those used for shifting rudders in the usual manner, and the elimination of the weight of fins and rudders will be a clear saving, if the arrangement proves practical.

The cabin, which is rigidly fastened to the underneath side of the ship, is to be equipped with sleeping and dining accommodations, individual radio, and every feature of modern transportation. It is so constructed that it can be converted into a bomber in three hours.

The new dirigible is 275 feet long and 75 feet in diameter at its greatest width. Its estimated load lift is 10,000 pounds, nearly one-third of its total gross lifting capacity being utilized, a more efficient lift than is achieved by most dirigibles. It will accommodate forty passengers, including the crew of ten, in addition to having space for freight.

Because of its adaptation to both commercial and military use, the Government, in accord with its policy of developing air facilities, is encouraging the manufacture of the new ship, and a million-dollar plant for their construction is to be built by the Metal Aircraft Corporation, the manufacturers, at Fullerton, California.

While ships of this capacity will be used principally in hauling passengers, mail, and light freight such as the railway express companies now handle, ships of larger dimensions can be constructed that will transport loads proportionately larger and heavier. Ships of this type can be built, according to the estimate of the manufacturers, for approximately two-thirds of the cost of dirigibles of similar size built in the usual way, a factor which is always of the first importance for commercial feasibility. When the time element is taken into consideration, that is, the life of the ship, the first cost is still less in comparison, for metal construction means long life.

Modern transportation demands a rapid, safe, and economical medium. These requirements the new dirigible seems to meet. With the amazing progress in weather forecasting through the new air-mass analysis system and the recently established data gathering and broadcasting service of the Government, the problem of safety should be more satisfactorily answered than by heavier-than-air craft. Low cost of construction and the ability to make frequent stops without great loss of time, should make it commercially practicable.

The present aim of the manufacturers is to establish short passenger and freight lines, expanding as rapidly as commercially feasible. With the long cruising radius of the ship, and the negligible ground equipment required, the scope of its service should be almost unlimited. A new confidence will return in the suitability of airships as adapted to modern travel.

END

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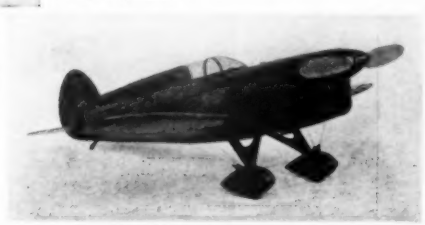

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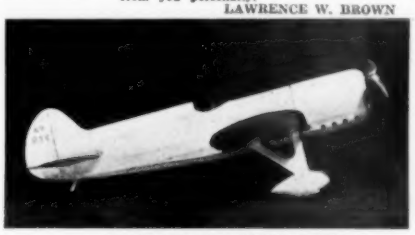

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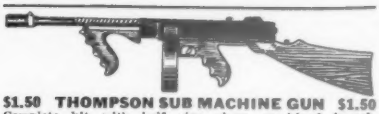

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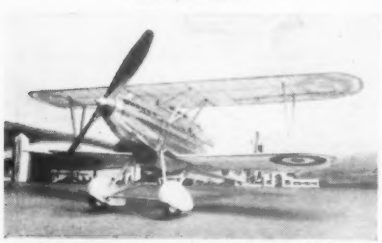

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Airlines
(Continued from page 146)

gear, wings, all flight controls and all instruments have been gone over with a fine-tooth comb. With the O.K. of the test pilot, the ship is placed back in service on United Air Lines.

During the earlier years of United's operations, when the company consisted of four divisions, Cheyenne was the operating headquarters and maintenance depot for the Boeing Air Transport division from Chicago to San Francisco. The location of headquarters at this point was obviously dictated by the fact that Cheyenne is the central point on the Great Lakes-Pacific Coast airways. Even after general operations control had been centralized in Chicago in the spring of 1934, the company continued to maintain separate repair and overhaul plants at Chicago (for the Chicago-New York and Chicago-Southwest lines); at Cheyenne; at Oakland (for the Pacific Coast route and western division of the coast-to-coast line); and at Portland (for the Salt Lake-Seattle equipment).

Previous differences in equipment, now standardized by use of the Boeing 247 and 247-D, had served to prevent the reorganization of the maintenance department on the foundation of one consolidated plant. The manner in which the present plan is working out testifies to its soundness, both as to efficiency and as to cost. United Air Lines employs approximately 400 people at its Cheyenne station and its payroll there is second largest in town, topped only by the railroad shops.

END

Model Dept.
(Continued from page 175)

Apply tissue to the various framework members, using a light grade of model-airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such upon a flat surface to keep from warping.

Next, apply a coat of clear dope to all surfaces. Now, apply colored dopes. Note, do not try to cover frame when it is completely assembled. Wings, elevators, etc., are cemented to fuselage after they have been completely covered with tissue.

ASSEMBLY

The wings, elevator, rudder, etc., should be cemented in their correct positions. The elevator is braced with two struts running on either side of fuselage outward to elevator. The flying and landing wires are made with a threaded needle which you force through the balsa. Thread is held in position with a drop of cement. The position of all spreader bars is clearly shown on photograph of finished model.

Two types of propellers are shown on the plan. The flying propeller, which has fiber blades, has less r.p.m., in order that the model can fly a greater distance. Plenty of patience is required to construct the propeller. It should be carefully adjusted until the best results are obtained. Four to six strands of 1/8-inch flat rubber are sufficient to fly the model. To balance the model, a small amount of weight can be added to the nose.

END

A PEERLESS ½" SCALE MODEL

Span 15"

Length 10½"

PEERLESS U.S. NAVY BOEING F4B-4

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Dealers: PEERLESS kits will bring you new customers and repeat business. Write for details.

Corben Super-Ace

(Continued from page 172)

along the spar as detailed and fasten to spars. Now cut and fit all of the compression members to their proper places. This can be done before the ribs are put on the spars, but a better fit can be obtained by fitting after the ribs are in place.

With all of the compression members nailed and glued in place, the next move is to install the tie-rods. The tie-rods used are in reality nothing more than long bolts made of high grade steel, having a head on one end and two lock nuts on the other. Therefore, the name "headed tie-rods." It will be well to insert all the tie-rods from the front, having the lock nuts at the rear. A special washer is used on both ends of the tie-rods as shown. Now to line up the wing.

Stretch a string along the front spar to be used as a guide. True up the root end of the wing with a large square by adjusting the tie-rods so as to pull the first bay square. Now fasten the string at the second bay and pull the wing into line so the spar and string line up. Then go out to the last bay and line it up so the spar and string line up the full length. Be sure that your wing lines up perfect. Do not pull the tie-rods too tight or the wing will twist. The tie-rods should be pulled up so they will sing when thumped with your finger.

The fittings are now bolted in place, using only aircraft bolts as detailed. Draw the bolts up snug and cotter key each one, as having a bolt work loose in flight would be embarrassing.

Attach the leading and trailing edges as shown on the plans. This is simple and will not need explaining. Now put the aluminum false ribs in place, spacing them half way between the main ribs. There are no false ribs at the root end of the wing which is to be covered with plywood. Before attaching the plywood at the root end, nail and glue ¼" square spruce strips along the rear edge of the front spar between the ribs at both top and bottom. Nail and glue the plywood to these strips.

If you have trouble getting the plywood to take the curve of the leading edge of the wing, it may be steamed and wrapped around the wing and held in place with string until dry, after which it is then glued and nailed. The ¼" spruce strips are also nailed to the rear spar at top and bottom along the aileron opening in the same manner. This will hold the fabric the same height as the ribs.

While the first Corben Super-Ace only had a wing spread of 25 feet, we have increased it to 27 feet. The 25-foot job flew very well and our only reason for increasing its wing is in favor of the fellows who live in high altitudes. As this increase naturally gives a quicker take-off and a slower landing speed, and by increasing the r.p.m. a little on the old Ford motor, we are still able to keep the speeds about the same.

I think that I have given you enough to keep you busy for another month and as the editor no doubt wants to have a little space left for some other articles of interest to the readers who are not interested in building a sport plane, I will zoom off and break a few more of my New Year's resolutions. Next month we will give you the dope for finishing the wings and installing the gas tanks in your Super-Ace.

END

Gliding

(Continued from page 171)

that you keep me posted as to your developments. I'll be back with more results and answers in the next issue if the response keeps up the way it started out.

The editor tells me that he will play ball with us as for this glider stuff, but we can't blame him for dropping it if we don't show him we are really interested. So, come on you birds that want to break into the flying game.

END

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(At right) War fighter NIEUPORT

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